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The

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WELLINGTON, NEW ZEALAND.

20TH JANUARY, 1917.

EUCALYPTS FOR SETTLERS.

FURTHER SPECIES AND WHERE TO PLANT THEM.

J. H. SIMMONDS, Auckland.

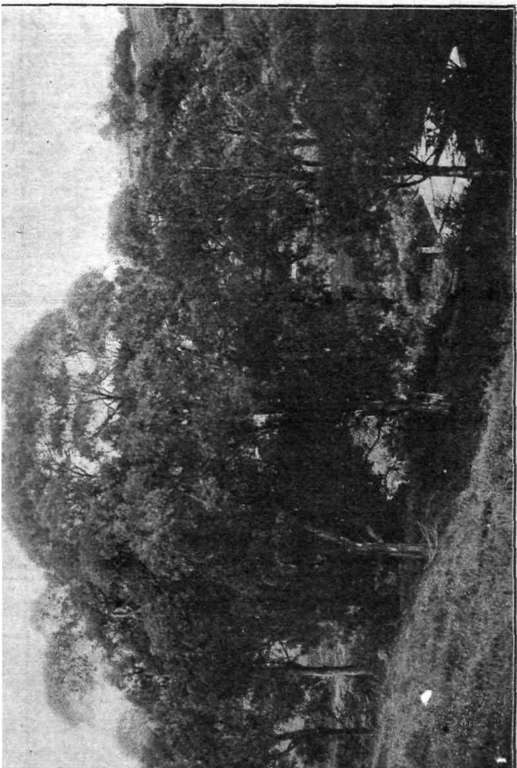
THE publication in this *Journal* in April last of an article on the growing of Eucalyptus trees for the purposes of the farmer — fencing, building, and firewood — has brought to the writer numerous requests for further and fuller information on the subject. Of the forty to fifty useful species that can be grown somewhere in New Zealand only twelve were described in the April issue. It was to be expected that many people would wish to know something about at least the more valuable and promising of the others. A further list of thirteen species is therefore selected for description in this second article. A constantly recurring inquiry has reference to conditions of climate and soil to be considered in making a choice of species for planting. This will be met as far as possible, partly by an attempt to group the species according to climatic requirements, partly by mentioning localities

where healthy and vigorous specimens may be actually seen growing, and partly by some general remarks to follow the specific descriptions. When it is suggested that a species will not be profitably cultivated farther south than a given latitude the reader must not understand that it cannot be grown at all farther south. *E. rostrata*, for example, may be found as a small tree in Canterbury and as a mere shrub in Otago. The writer's aim is to indicate the economic range of each species, not the utmost limit within which it may be represented by arboretum specimens. A less frequent but very important question has reference to the methods to be employed in converting Eucalyptus trees to use after they have attained a sufficient standard of maturity. This also will be discussed as far as space available will permit.

SPECIES THAT REQUIRE WARM AND GENIAL CONDITIONS, AND WILL PROBABLY NOT BE PROFITABLY CULTIVATED FARTHER SOUTH THAN THE LATITUDE OF HAMILTON UNLESS IN ESPECIALLY FAVOURED LOCALITIES.

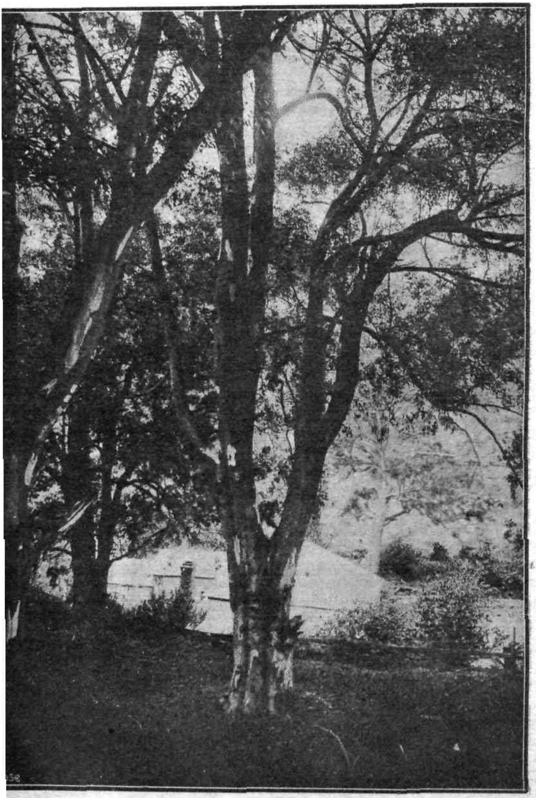
Eucalyptus capitellata, Smith.—The tree usually carries a heavy and dense mass of foliage. Its dead bark persists on the stem and large branches, and is of the stringy fibrous type. The leaves of the very young plant are round or heart-shaped and almost sessile or stalkless; those of the adult tree are stalked (petiolate), thick, broad for their length, usually very unequal-sided, and of about the same green on the two surfaces. The common stalk (peduncle) of the umbel or flower-cluster is compressed and angular, and its flowers, of which there may be as many as ten or eleven in the head, are sessile or on extremely short stalklets (pedicels). The buds are coarse, angular, and have a short pointed lid (operculum). The mature seed-case is often remarkable for being broader than it is deep, its appearance suggesting the idea of a plastic sphere that has been pressed into the shape of a thick disk. The rim is usually broad and convex, and the points of the valves when open are just below or slightly above it. As the sessile fruits mature they press tightly against each other and become more or less flattened at the sides by the pressure. The specific name was suggested by the compact and rounded form of the ripe fruit-cluster.

The species is indigenous to New South Wales, Victoria, and South Australia, where it has a good reputation for its rate of growth and size, and also for the durability and quality of its timber. Arboretum specimens have done well at Wesley Training College (Auckland). One of them, now ten years old, has a height



A GROUP OF EUCALYPTUS PUNCTATA, FORTY-FIVE TO FIFTY YEARS OLD.

Height of largest tree, 90 ft.; diameter, 3 ft. 11 in. Grounds of Misses Rosewarne and Willis, Bell Road, Remuera, Auckland.



EARER VIEW OF EUCALYPTUS PUNCTATA TREES, IN GROUNDS OF MISSES ROSE-WARNE AND WILLIS, REMUERA, AUCKLAND.

of 43 ft. and a diameter of 1 ft. 2 in. Here and farther north the species appears to be perfectly at home; but no good specimen has yet been noted by the writer south of Auckland.

Eucalyptus punctata, De Candolle.—The tree when grown in an open situation carries a spreading mass of branches and foliage, and is very ornamental; under suitable conditions it would make a long clean bole. The dead bark is non-fibrous and comes away in sheets or large scales, the newly exposed patches being paler in colour, and the general aspect dull mottled grey. "Leather-jacket" is a bushman's name for the tree, suggested by the appearance and texture of the bark. The species is one of those whose leaves do not greatly change in form. Those of the adult tree are on long stalks, lance-shaped or curved a little to one side; the principal lateral veins are numerous and nearly parallel, the intramarginal vein near the edge; the upper surface is dark green and shiny, the under-surface paler and dull. The umbel has a flattened stalk, and the flowers, of which there are four to ten in the head, are on medium-length stalklets. The lid of the bud is conical, and has the appearance of fitting exactly into the rim of the calyx-tube (unripe seed-case). The mature seed-case has the shape of half or two-thirds of an egg; the rim is flat or slightly convex, and the open valves sometimes rise a little above it. The wood is said to be red or pale reddish-brown, excellent for fencing-posts or firewood, but difficult to split.

Trees in Hobson Bay, Auckland, now forty-five to fifty years old, have attained a large size; and seedlings that have sprung up around them are making rapid healthy growth. Plants propagated from these same trees are doing well and proving hardy in various localities. The species appears to be well worthy of cultivation in districts where there are no very severe frosts. *E. propinqua*, H. D. and J. H. M., is a species of closely similar description and value to *E. punctata*.

Eucalyptus paniculata, Smith.—The tree is of erect habit, and when grown as a single specimen on good soil in a sheltered situation is very ornamental. Under forest conditions it develops a straight but not very large bole. The dead bark persists on the stem and large branches, and is non-fibrous, hard, regularly furrowed longitudinally, and pale grey in colour. The juvenile leaves and those of the adult tree are not very different; they are stalked, lance-shaped, nearly equal-sided, and paler green on the under-surface; the main lateral veins are nearly parallel and

ROW OF EUCALYPTUS PANICULATA AT WESLEY TRAINING COLLEGE, AUCKLAND.

Age, seventeen years; height, 50 ft. to 55 ft.; diameter, 1 ft.

the intramarginal vein close to the edge. The umbel or flower-cluster has a long, slender, and somewhat compressed stalk, and consists of five to seven or more flowers on short angular stalklets. The lid of the bud is low-conical. The mature seed-case is small, its shape being like that of an egg with about a third cut away. The valves, which are sometimes five in number, are sunk, their tips when open not rising above the narrow rim. The umbels often appear in compound clusters or panicles at the ends of the twigs, which character, though shared by several other eucalypts, suggested to the botanist J. E. Smith the specific name *paniculata*.

The species is the best of that extremely valuable group known as ironbarks. Its timber is the "white" or "grey ironbark" of commerce, and is almost world-renowned for its strength, hardness, and durability. It is a species that requires for its best development a warm climate and good soil. The largest specimens known to the writer in New Zealand are at Wesley Training College. Some of these are now seventeen years old, and have reached a height of 55 ft. to 60 ft. and a diameter of 1 ft. The trees are healthy and in good growing condition. The other ironbarks, as placed in order of merit by J. H. Maiden, are *E. crebra* and *E. siderophloia*, which have not yet responded satisfactorily to experiment in this country; *E. sideroxylon*, which will be described in another paragraph; and *E. melanophloia*, which is an inland species of insufficient merit for economic cultivation.

Eucalyptus sideroxylon (ironwood), A. Cunningham. — The tree has a tendency to develop a crooked stem and spreading open top. The dead bark persists on the stem and large branches, and is very hard and thick, deeply furrowed, and of a dark "burnt-cake" colour. The leaves of adult trees are usually larger and thicker than those on young plants, but otherwise not very different. They are stalked, lance-shaped, nearly equal-sided, leathery, and of the same slaty or dull silver green on the two surfaces. On stump-sprouts and on young saplings leaves will sometimes be seen that are broader and larger than the average of those on adult trees, but this form may be regarded as intermediate and transitional. The umbel has a long stalk and three to five flowers on long stalklets. The lid of the bud is rather long, and conical; the mature seed-case is deep urn-shaped, and usually above medium size; the valves are deeply sunk, and the dead stamens often remain adherent to the interior of the orifice after the fruit is mature. Some trees have flowers of a rich pink to crimson colour, and are very ornamental. The heart-wood is deep red in colour and very durable.

SPECIMEN OF EUCALYPTUS SIDEROXYLON (STEM PARTLY HIDDEN BY WALL AND SHRUBS) AT WESLEY TRAINING COLLEGE.

Age, eighteen years; height, 53 ft.; diameter, 1 ft.

Through similarity of fruits *E. sideroxylon*, which is one of the most marked of the ironbarks, was for some years confused with a smooth-barked tree now known as *E. leucoxylon* (whitewood). The distinction is now well understood. Vigorous specimens of *E. sideroxylon* may be seen at Wesley Training College, in some of the Auckland railway reserves, in private plantations as far inland as Piako and Cambridge, and in the grounds of Miss Williams, "Frimley," Hawke's Bay. It is certain that the species can be grown over a wide range in our northern districts; but people who plant it must not expect an early or heavy return of timber.

Eucalyptus rostrata, Schlechtendal.—In open situations the tree forms a somewhat crooked stem crowned with spreading open branches and slender drooping branchlets; but grown under forest conditions on good land with deep moist subsoil it will develop a straight bole and rise to a height of 100 ft. The bark is usually described as smooth, but this only means that it is neither furrowed nor fibrous. The dead portion often persists at the base of the stem until it forms coarse plates divided by deep cracks; higher up the tree it may come off in thin sheets or scales. The seedling leaves are rather narrow and early become stalked; those of the adult tree are long, curved to one side, and of the same rather dull green on the two surfaces. The umbel has a long slender stalk, and consists of several flowers on slender stalklets. The bud is small and delicately formed, the lid being remarkable for having a rounded base equal in diameter to the calyx-tube (immature seed-case), and then suddenly contracting into a pointed apex. It is from this beak-like appearance of the bud that the species takes its name. The seed-case is small and hemispherical, with a rising convex rim. The valves spring from within the rim, forming while closed a low cone or dome, and being strongly exserted or protruded when open. The heart-wood timber is of a rich red colour, and exceedingly durable in any situation.

The natural habitat of the species is on alluvial flats and along river-banks in eastern Australia, especially along the River Murray, whence it is called "Murray red-gum." Small numbers of trees have grown to a large size in the Waikato near Cambridge, and to a fair size in Hawke's Bay and in the Rangitikei district; but we must not expect that the species will be profitably cultivated so far south as any of these localities. Arboretum specimens on good land at Wesley Training College have in twelve years reached a height of 50 ft. and a diameter of 1 ft. 3 in. This is a rapid rate of growth for a hardwood of such high merit; and if

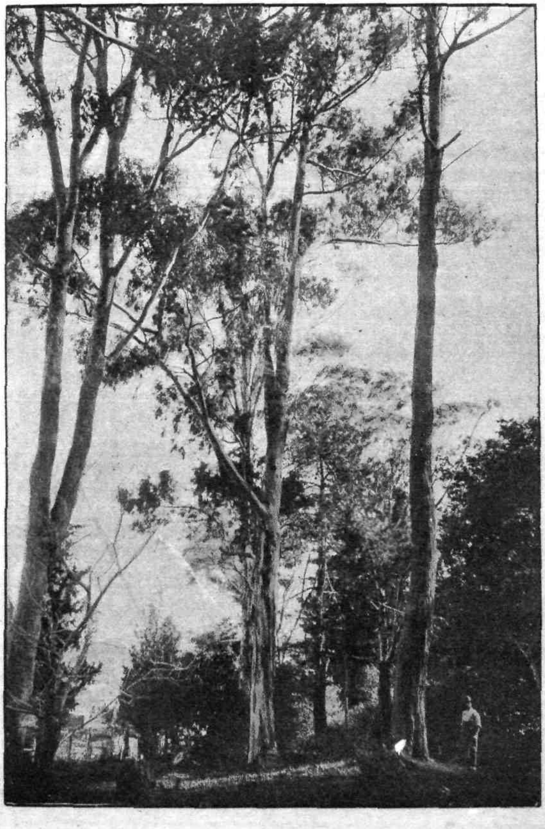
the species were given a fair trial still farther north in some of the river-valleys results should be very satisfactory.

Eucalyptus tereticornis, Smith.—In general appearance, bark, and leaves typical adult trees of this species resemble those of *E. rostrata*, though they often exhibit a taller and more erect habit of growth. The heart-wood of the two species is closely similar in colour and quality. Distinguishing characters will, however, be found in the juvenile foliage and in the parts of the flower-cluster or umbel. In *E. rostrata* the leaves of seedlings and stump-sprouts are rather narrow and long; in *E. tereticornis* they are broad with a tendency to an ovate or orbicular shape. In *E. rostrata*, as we have seen, the parts of the umbel are small and delicately formed; in *E. tereticornis* they are closely similar in form and arrangement, but usually a little larger and coarser. "Tereticornis" means round- or smooth-horned, and was given to this species because the lids of its buds are horn-like, either blunt conical or long and pointed with a curve to one side. Several other eucalypts have horn-like buds, but the character in this connection serves to distinguish *E. tereticornis* from *E. rostrata*.

In its native home, eastern Australia, *E. tereticornis* has yielded an immense amount of timber of very high merit. In New Zealand millable or nearly millable specimens may be seen on the property of Mr. W. C. Harrison, at "Hakowhai," Hawke's Bay; in the Waikato; in the grounds of Sir James Wilson, Bull's; and on the Auckland Isthmus. Like *E. rostrata*, it will do best where the climate is warm and the land good. Northern settlers are advised to give it a trial in suitable localities, but extensive planting of it cannot be recommended at the present stage of our experience.

SPECIES THAT ARE MODERATELY FROST-RESISTANT AFTER THEY PASS THE SEEDLING STAGE, BUT WILL PROBABLY NOT BE PROFITABLY CULTIVATED FARTHER SOUTH THAN THE LATITUDE OF ROTORUA UNLESS IN ESPECIALLY FAVOURED LOCALITIES.

Eucalyptus eugenioides, Sieber.—The tree is of erect habit and rapid growth, with a tendency to shed all lateral branches and form ultimately a very tall, straight shaft crowned with a comparatively small amount of foliage. The dead bark is stringy, and persists right up the stem and larger branches. In the juvenile stage the leaves are very short-stalked, and wavy and indented at the edges, the under-surface being of a paler green; the stems of the twigs and the backs and edges of the leaves are then studded over with



AN INTERESTING GROUP IN GROUNDS OF MRS. KINDER, ARNEY ROAD, REMUERA, AUCKLAND.

E. tereticornis in centre; *E. eugenioides* (120 ft. high) on right; specimen of kindred genus, Angophora, on left.

tufts of tiny hairs, the general colouring of the young foliage in this stage being dull green tinged with russet-brown. The leaves of the adult tree are stalked, smooth, unequal-sided, of the same green on the two surfaces, and medium in width and length. The umbel has a rather long stalk and numerous flowers on short stalklets. The buds have short pointed lids. The seed-cases are globular or depressed-globular, contracted at the orifice, with a rim that is usually convex but sometimes flat, the open valves being just hidden by the rim or slightly protruded (exserted). As the fruits mature they touch and form a compact head, but, having short stalklets, never become so tightly compressed together as do those of *E. capitellata*, which are usually quite sessile.

The heart-wood of *E. eugenioides* is brown to pale red in colour, splits very freely, and is also excellent for sawing into boards and scantling. In its native home in the mountains of New South Wales and Queensland it is praised as a good lasting timber for fencing-posts, and our own experience, so far as it goes, confirms that reputation. The seedlings transplant badly, and the seed should therefore be sown where the trees are to grow. A small area on the Thornton Road, near Cambridge (now belonging to Mr. J. O'Dwyer), sown in this way about thirty-nine years ago had in 1915 still upon it, after numerous thinnings, many splendid shafts of timber fit for sawing into boards and scantling or splitting into fencing-posts. Other specimens are doing well in the State forest plantations at Whakarewarewa and about Auckland. A species of such high merit, already so successfully tested, is certainly worthy of further planting in suitable localities.

Eucalyptus Muelleriana, Howitt.—The tree is of erect habit, and under favourable conditions develops a long straight bole. It is a stringybark of similar general appearance to *E. eugenioides*. On close comparison, however, it can be distinguished from that species by the less stringy texture of its bark, by a brighter sheen of its leaves, and by the larger size, longer stalklets, and less crowded arrangement of its seed-cases. Some of its characters suggest affinity with *E. pilularis* rather than with *E. eugenioides*. Vigorous specimens may be seen in the railway reserve, Rotorua, and in the State plantations at Whakarewarewa. Advice from Australia is to the effect that *E. eugenioides* is a better tree than *E. Muelleriana*, but that the latter is more frost-resistant. Our New Zealand experience is not yet sufficient for forming a positive opinion as to the relative merits of the two species.

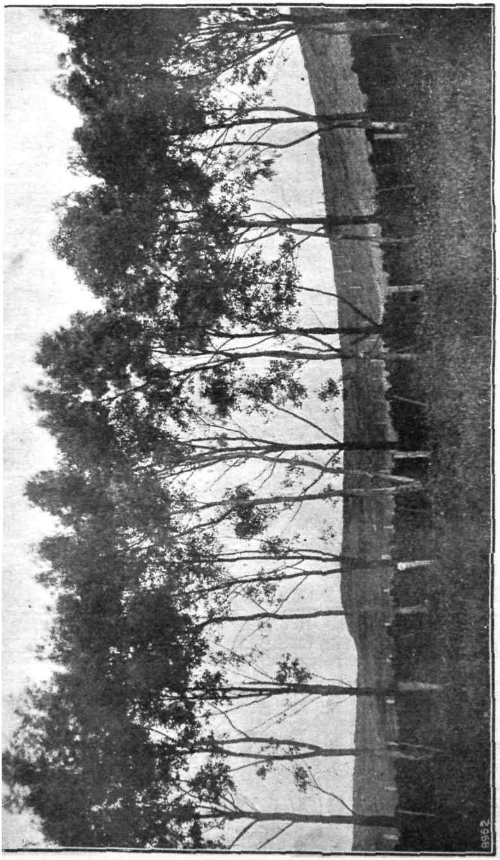
Eucalyptus Sieberiana, F. von Mueller.—The tree when typical and vigorous has a straight stem crowned with abundant dark-green foliage. The dead bark persists both on the stem and larger branches; on young trees it is scaly, on old ones sub-fibrous, thick, firm, and deeply furrowed, the colour being a peculiar brown-grey easily remembered when once noted. The juvenile leaves are stalked, hang vertically, and together with the twigs are usually covered with a slight glaucous bloom; those of the adult tree are of the same dark shiny green on the two surfaces, long, and with lateral veins at very acute angles to the midrib. The umbel has a flattened stalk with several angular-stemmed flowers. The bud is club-shaped, with short hemi-spherical sometimes umbonate lid. The mature seed-case is pear-shaped, its rim being flat or countersunk with sharp edge; the valves do not show above the rim. The timber is described as pale-coloured and fissile; suitable for inside work, but not durable when exposed to the weather.

Trees of *E. Sieberiana* have grown to a large size in railway reserves and private plantations in the Auckland Province. The species is indigenous to the mountains of south-eastern Australia, where it sometimes has to endure very low temperatures. We in New Zealand find that the seedlings are sensitive to frost and resentful of transplantation, but that the trees when well established soon become vigorous and strongly frost-resistant. Splendid specimens may be seen in the grounds of Mr. H. B. Morton, at Tarukenga, and in the State plantations at Whakarewarewa. The former, now only twenty years old, are nearly 100 ft. high.

SPECIES THAT HAVE ALREADY BEEN SUCCESSFULLY CULTIVATED IN NUMEROUS LOCALITIES IN BOTH ISLANDS.

Eucalyptus amygdalina, Labillardière.—In earlier botanical literature this name was applied to a wide group of trees several of which are now described as distinct species. The very tall trees mentioned by Baron F. von Mueller in his Eucalyptographia and Select Extra Tropical Plants under this heading have since received specific rank as *E. regnans*. Even now the name stands for two quite distinct types, one Australian and the other Tasmanian.

The Australian type: This is a medium- to large-sized tree, often with spreading top and drooping branchlets. The dead bark persists on the stem and large branches, and is fibrous with a web-like texture ("peppermint-bark"). The leaves are lance-shaped, pointed, thin, and of about the same green on the two surfaces; sessile and opposite on the young plant, stalked and



DOUBLE ROW OF EUCALYPTS, WITH NARROW-LEAVED TASMANIAN E. AMYGDALINA IN FRONT AND E. ROBUSTA AT BACK.

Age, nine years; height, 40 ft. The post with white mark at top was cut from a branch of *E. amygdalina* and put in the ground three years ago, and as yet shows no sign of decay.

scattered on the adult tree. The umbel bears an indefinite number of small flowers; the lid of the bud is domed and short. The seed-case is small, pilular or hemispherical; the rim convex or flat, the tips of the open valves usually below the rim, but sometimes slightly above it. This tree grows in the hilly country of eastern Australia, and is there valued for sawing into boards and scantling. The largest specimens known to the writer in New Zealand will be found on Mr. Alfred Totman's farm, a few miles from the Hinuera Railway-station, Auckland–Rotorua line. They are now about twenty years old, from 60 ft. to 80 ft. high, with a diameter of about 1 ft. to 1 ft. 4 in. Their condition is vigorous, and, as they are growing on a low flat where frosts are severe, they may be safely regarded as strongly frost-resistant. Younger specimens in a vigorous state of growth may be seen in the grounds of Mr. Archibald McLean, "Green Hill," and in other localities in Hawke's Bay. Mr. T. W. Adams has a tree or two at Greendale, Canterbury, and there are one or two specimens in the Botanic Gardens, Invercargill.

The Tasmanian type: In Tasmania there is a group of eucalypts with buds and seed-cases closely similar to those of the Australian *E. amygdalina,* but with leaves that are leathery and narrow, sometimes so narrow as to be almost linear. Some trees carry a fibrous web-like dead bark on the lower stem; others have a wholly non-fibrous bark, the dead portion of which they shed in scales or patches. According to L. Rodway there is no rigid line of distinction by which the numerous variations can be separated, but in a general way the trees fall into two main subgroups. (See "Tasmanian Forestry," page 30.) (1.) There are those with light-coloured and almost smooth bark, very narrow leaves, and small seed-cases. These are called by the bushmen "white peppermint" and by the botanists *E. linearis,* Dehnhardt. The trees are often of small dimensions, and their timber is understood to be of secondary value. (2.) There are those with darker and coarser bark, slightly wider leaves, and larger seed-cases. These are called by the bushmen "black peppermint" and by the botanists *E. amygdalina,* Labill. They often grow to a fairly large size, and their heart-wood has the reputation of being exceedingly durable in contact with the ground. Mr. Rodway in a letter recently received states that posts split out of these trees have to his certain knowledge lasted fifty to sixty years. The trees are hardy, ornamental, and moderately rapid in growth, and the timber is said to be freely fissile. People in New Zealand have long been aware of the very high value of the Tasmanian black

peppermint, and have consequently been importing seed under this name or under the botanical name *E. amygdalina ;* but there is too much reason to suspect that our parcels have not always been collected from the best timber-yielding strain, and that we have in a good many instances received *E. linearis* instead of *E. amygdalina.* Among many thousands of specimens now growing in New Zealand the largest and best known to the writer will be found in the splendid plantations around the "Mansion," Cheviot, Canterbury, and in the grounds of Mr. F. S. Waterhouse, "Mangawhare," and of Sir Andrew Russell, "Tunanui," Hawke's Bay. In Otago, at Waitati, a narrow-leaved form of this species or group is represented by a few large trees and numerous saplings of useful size, the natural regeneration being only less remarkable than that of the companion eucalypt, *E. regnans,* there growing so vigorously. A fallen tree and a sapling felled both showed a large percentage of dark-coloured heart-wood. In the interests of farmers it is urgently desirable that steps shall be taken without delay to obtain a supply of seed from certified trees of the best type, either in our own country or in the original home of the species.

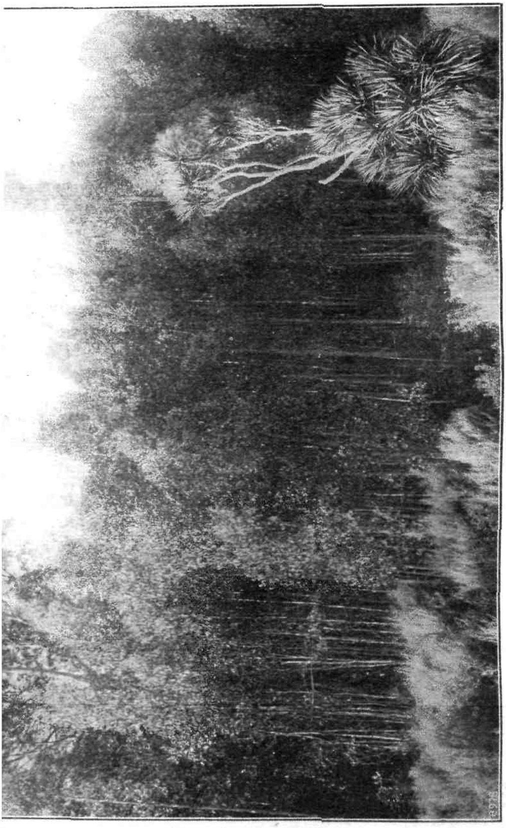
Eucalyptus Risdoni, Hooker f. ; variety *elata,* Bentham. — The species is indigenous to Tasmania. The typical form is small and of inferior economic value ; but the tall variety (*elata*) as we know it in New Zealand grows rapidly into a medium-sized, beautiful, and useful tree. The branchlets have a drooping habit ; and the young growth, especially during the earlier years of the tree's life, is often thickly covered with a glaucous bloom as if it had been dusted with lime. The bark is of the type described as smooth, the dead portion scaling off in irregular patches, and the general colour being a dull grey. The juvenile leaves are sessile, opposite, sometimes united at their bases (connate), heart-shaped or broad lance-shaped ; those of the adult tree are stalked, alternate or scattered, long, rather narrow. The umbel has a medium-length stalk and an indefinte number of flowers on short stalklets. The bud is club-shaped with a domed lid. The seed-case is of medium size and takes the form of a broad spinning-top ; the rim is subject to great variation, being either counter-sunk or convex, or sometimes divided into an inner and outer ring by a shallow groove. The tips of the valves when open are usually below but occasionally above the rim.

The tall *E. Risdoni* is represented by numerous vigorous specimens in the State plantations at Waiotapu and in North Canterbury. In the grounds of Mr. T. W. Adams, Greendale, and in the Selwyn plantations many trees have reached a height of 60 ft. to

80 ft., with a diameter of 1 ft. 6 in. Some of them have been split into fencing-posts, which are now under test. A log split in the writer's presence in one of the Selwyn plantations showed a large percentage of darkish-coloured heart-wood of a compact but freely fissile character. Farther south in Canterbury the species declines in vigour, and in Otago it ceases to be worth growing. Seed should be collected from the largest and best of the North Canterbury or Waiotapu specimens.

Eucalyptus regnans, F. von Mueller.—This is one of the species the botanical definition of which has been slow in coming to a final settlement. Baron von Mueller at first included it under *E. amygdalina*, Labill., as a smooth-barked and very tall variety. Later he came to regard it as a distinct species, and named it *E. regnans*. Trees agreeing generally with the new definition were found over a wide range in both Tasmania and south-eastern Australia. Then J. H. Maiden observed that certain trees in New South Wales that had previously been included loosely under *E. regnans* possessed distinctive characters. He recorded the distinction and tentatively placed these similar but evidently differing trees as a variety of *E. regnans* under the name of *E. fastigata*. Baker and Smith adopted the view that Maiden's variety was a distinct species. Both trees are represented by numerous specimens in New Zealand. They certainly have much in common. Both have thin more or less unequal-sided leaves; both in their mature state carry fibrous dead bark to a greater or less extent; both have numerous flowers in the umbel and produce the umbels in pairs; and both have narrow, top-shaped, and usually three-celled seed-cases of about the same size. But *E. regnans* differs from *E. fastigata* in having broader and less gradually tapering leaves, in the ribbony or smooth condition of the upper stem and branches, and in having the rim of the seed-case flat, convex, or countersunk instead of domed. The difference in foliage appears when the seedlings are still very young. In both cases the leaves very early become distinctly stalked or petiolate; but those of *E. fastigata* are narrower and more pointed, while those of *E. regnans* approach the broader *E. obliqua* type. When the trees are mature the most obvious difference is that of the bark, *E. fastigata* being a stringybark up to the smaller branches, and *E. regnans* still having a shaft of ribbony or smooth stem above the 10 ft. to 15 ft. or 20 ft. of fibrous-barked base.

The most remarkable representation of *E. regnans* in New Zealand is in the Mental Hospital grounds at Waitati, in Otago,



NATURAL PLANTATION OF EUCALYPTS AT WAITATI, OTAGO.

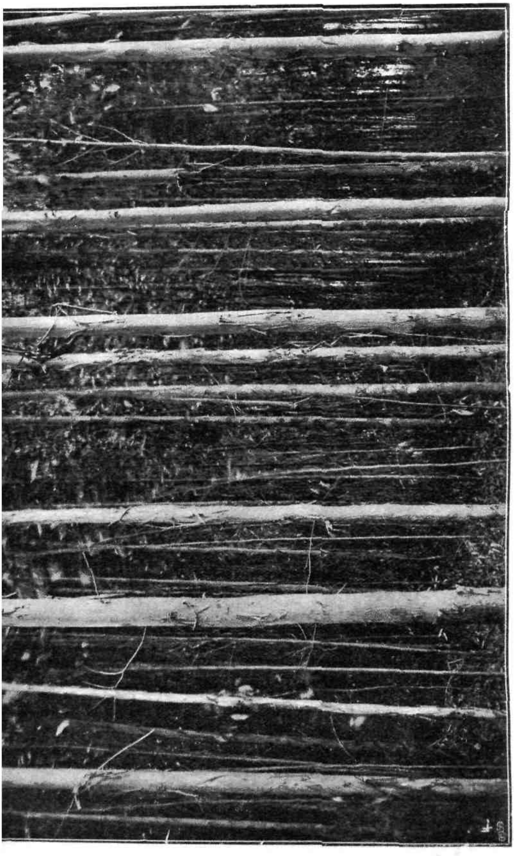
Mainly *E. regnans*, but partly a very narrow-leaved form of the Tasmanian *E. amygdalina*. One of the original parent trees seen on left behind the saplings.

where a few parent trees over forty years old have scattered their seed and given birth to a forest of saplings. Many of the saplings, though probably not more than sixteen years old, have reached a height of 80 ft. to 90 ft. and a diameter of over 1 ft. Other Otago specimens will be found in what is known as the Corner Bush, not far from Waikouaiti, and in the grounds of Mr. Allen S. Orbell, "The River Station," where one tree measured a height of 110 ft. and a diameter of 2 ft. 5 in. In Hawke's Bay Mr. Bernard Chambers has a stand of young *E. regnans*, now about 40 ft. high; Mr. A. C. Russell, of Hatuma, six large trees, one of which measures 117 ft. in height and 3 ft. 4 in. in diameter; Mr. F. S. Waterhouse, at "Mangawhare," a few fine trees of nearly equal dimensions; and Mr. R. H. Tod, of Otane, younger but vigorous specimens. In Manawatu Mr. W. J. Phillips, in his grounds near Sanson, has several trees that rival the companion specimens of *E. obliqua* and *E. globulus* in size and vigour. One large tree has been reported from Wairarapa, and another can be shown by Mr. Edmund Somerville, of "Woodstock," Okoroire.

E. regnans is one of the most valuable of the eucalypts for sawing into boards, scantling, gate material, and battens. It is a very free splitter, and full-sized posts taken from mature heart-wood should last twelve to fifteen years. The species is easily propagated, strongly frost-resistant, and a very rapid grower. Looking at all its merits in view of future requirements, one need have no hesitation in recommending it for extensive planting, with the reservation, however, that *E. fastigata* is probably a still more valuable tree to plant where soil and climate will permit it to make equally rapid and vigorous growth.

SPECIES THAT WILL ENDURE VERY SEVERE FROSTS AND MAY BE SUCCESSFULLY CULTIVATED ON COLD UPLANDS AND IN THE FAR SOUTH WHERE LARGER AND BETTER SPECIES REFUSE TO GROW.

Eucalyptus coriacea, A. Cunningham (*pauciflora*, Sieber).—The tree is small to medium in size, often with spreading top and drooping branchlets. Coarse sheets or plates of dead bark may be carried at the base of the stem, but otherwise the surface of both stem and branches is smooth and white. The leaves in the juvenile stage are short-stalked, opposite, wide at the base, pointed at the apex; on the adult tree they are stalked, thick, and leathery (whence specific name, *coriacea*), long, lance-shaped with a curve to one side, often with a hook at the apex. The lateral veins



INTERIOR OF NATURAL PLANTATION OF EUCALYPTUS REGNANS, WAITATI.

Some of these trees measure 80 ft. to 90 ft. in height and over 1 ft. in diameter. Sub-fibrous bark is beginning to persist at base of larger stems, after the manner of adult trees of this species.

are distinct and form very acute angles with the midrib, several springing from the base of the midrib and running through nearly the whole length of the leaf. The umbel has a medium-length stalk, and carries several flowers on short stalklets. The lid of the bud is hemispherical. The seed-case is usually three-celled, of medium size, and in shape something like a pear with the calyx end cut away; the rim is thick, the open valves usually concealed by the rim.

It has been understood that the species is common to Australia and Tasmania, but a doubt has been raised by R. T. Baker as to the specific identity of the trees on the island with those of the mainland. The Australian variety is probably the better tree, and is certainly very remarkable for the wide range within which it can maintain vigorous life—from the winter-snow line on high mountains to lowlands near the sea. The species is widely distributed in both south and north of New Zealand, and is hardy everywhere. Many of the specimens are extremely ornamental. The tree is excellent for shelter and firewood. Some Australian reports say its heart-wood when mature is also very durable when used as fencing-posts. No one with competent knowledge would think of recommending this species for general planting. Its place will be found in some of those less favoured localities where most or all of the larger and better euclaypts refuse to grow. In any such locality a good stand of *E. coriacea* will be a very valuable asset. Sieber's name is singularly inappropriate, as the trees bloom profusely and yield a large amount of honey for bees.

(To be continued.)

Note.—The concluding part of this article, to be published in next month's *Journal*, will deal with climatic conditions and soil as affecting eucalypts, general rule for selection of species, second crops from stumps, conversion of trees into posts and building-timber, and the great prospective value of trees generally.—*Editor.*

Opinions differ as to the value of salting .he haystack, but when cows are feeding on roots or green forage they certainly prefer salted to unsalted hay, and in this case they are no doubt the best judges. The addition of from 25 lb. to 30 lb. of salt to each ton of hay in 'he stack not only makes the hay more palatable to the cows, but is an additional safeguard against digestive disturbances when the hay is used in conjunction with roots or green fodder. Rock salt should, of course, be in every pasture.

MUSHROOM-CULTURE.

C. CRAIGIE, Fruit Inspector, Wellington.

In consideration of the prices obtained for that most excellent vegetable the edible mushroom, when in season, it is surprising that our more enterprising market-gardeners do not make some effort to augment the supply by producing crops during the period when it is not obtainable from the pastures.

Possibly their failure to do so may be attributed to the long-held and mistaken idea that much knowledge is required to ensure success in mushroom-culture, or it may be through lack of confidence in their ability to find a profitable market for their produce. While the experienced mushroom-grower can be confident of successful results, experience and a wider knowledge of the subject have shown that an intelligent novice, if working on well-advised lines, may also be reasonably certain of results which will repay him well for his labour and the small capital invested.

In studying costs of production and comparing them with probable returns obtainable it is unwise to allow the imagination to soar unlimitedly, but it must also be borne in mind that the average price realized throughout the brief period when mushrooms from the natural supply are on our markets will not form a fair foundation upon which to calculate. Such a price would be much below that which might be obtained for a well-grown crop placed on the market before the supply from the pastures enters into competition. There are always those in the community who are willing to pay well for having on their menus little delicacies such as the mushroom, and for the supply of this market in New Zealand there is ample scope for the profitable investment of small capital.

In this article the writer will endeavour to give some helpful advice (based on his own experience in England) to those who may have the desire to take up mushroom-cultivation as a business, or, what is more likely to meet with success, as a side-line in connection with an existing business. For the better understanding of the principles underlying the artificial production of mushrooms we may consider for a moment a few of the points a knowledge of which may make all the difference between success and comparative failure.

THE SPAWN.

The mushroom is not a plant in the sense in which the word is generally used, but belongs to a lower order of the vegetable kingdom known as fungi. For reproductive purposes the mushroom produces spores, fine dust-like particles, which for a fungus perform similar functions to those carried out by the seeds of the higher plants. Those spores, however, are of so little economic importance that they may be left out of consideration. Tended by nature in her own way they are disseminated by the wind, and on finding suitable resting-places germinate and produce fresh colonies, but artificially they are seldom used except by highly skilled growers.

The material employed in planting beds for artificial production is the mycelium, or, as it is commonly termed, the "spawn." If a spadeful of earth around a group of mushrooms be dug up and examined there will be observed a number of white, woolly, thread-like growths branching in all directions through the soil. This (the truly vegetative part of the fungus, from which is produced above ground the reproductive organs in the mushroom itself) is the mycelium, or spawn.

The manufacturer of "spawn-cakes," as they are termed, transplants a portion of this mycelium into small bricks or cakes made usually from a mixture of clay and cow or horse manure. These are then subjected to a cultural process which causes the spawn to grow and ramify until the cakes are thoroughly impregnated throughout, when they are dried ready for sale. In this desiccated state the spawn may be stored or shipped to oversea buyers for use in planting mushroom-beds.

As spawn-cakes are not produced in New Zealand, and probably not in Australasia, any one proposing to take up mushroom-cultivation should order in advance, allowing at least four months for procuring supplies from English or French sources. They may be obtained through any reliable seed firm, and, in purchasing, a guarantee should be asked for that the cakes are from fresh stocks, as the mycelium contained in them deteriorates with long keeping.

PREPARATION OF THE BEDS.—MANURE AND SOIL.

The natural habitat of the mushroom is in old rich pasture land, where it may at times be found in abundance, but it will only crop for a brief period of the year and cannot be induced to alter its natural course. The gardener who wishes to produce money-making crops at a season when these uncultivated competitors will not come upon the scene must have his source of production completely under control, and for this purpose he pre-

pares special beds made up of fermenting manure with a covering of soil.

As the results achieved will be largely governed by the preparation of the manure prior to making up the beds, this part of the subject cannot be too much enlarged upon. The best medium for a rapid and vigorous growth of the mycelium is undoubtedly horse-manure. Only manure which is quite fresh should be purchased, otherwise it may have been spoiled by standing in a stable-yard where no attention has been given to its proper fermentation for the work required of it. Manure which has been obtained from hardworked horses is always to be preferred, on account of the extra quantities of hard nitrogenous food usually given to them. This factor has been proved to have quite an important bearing on the quality and quantity of the resulting produce.

Although much has been written regarding the advisability of securing manure without straw, or of shaking out any straw which it may contain when received, experience has proved this practice to be not only unnecessary but calculated to reduce to some extent the quality of the manure. If the manure when received contains an excess of long straw in comparison with the animal excrement present, some of this is better removed, so that there remains at least as much excrement as straw. The reason for this is twofold. In the first place, if the straw is in excess the fermentation will probably be too fiery at first and will not be extended over a sufficiently long period; secondly, the sinkage of the bed consequent upon this rapid fermentation and decay will be more or less detrimental to the growing mycelium.

An open shed or other position similarly sheltered from the elements, in which to prepare the manure, is desirable, as during this process it should not be allowed to become too wet or too dry

The material should be cast up in a long heap about 3½ ft. to 4 ft. high, its length varying according to the quantity being handled. If a greater bulk of material is placed in one large heap its fermentation is not so easily controlled. Unless very wet when delivered the material should receive a watering while being stacked, to induce fermentation, and should be trodden down fairly firmly. Fermentation, denoted by heating and steam rising from the heap, will in two or three days have made some headway. The stack should then be turned over, endeavouring as far as possible to place the outside layers to the inside, and *vice versa*, in order to obtain an even fermentation throughout. Further watering should be applied to places showing a tendency to become dried out.

If much dryness is present, patches of greyish-white dusty appearance will be observable. The worst of these are better removed entirely, as when in this condition they can only be remoistened with difficulty. Two or more turnings may be necessary before the material is ready for use.

As fermentation proceeds the manure will be found to have become reduced in bulk, but the original height of the heap should be maintained either by shortening its length or narrowing its width. The object aimed at in so treating the manure is the elimination of the first rank fiery heat, which would be sufficient to kill the spawn if planted in it when first obtained in the fresh state, also to sweeten the material and render it in such a condition that after the beds are made up a genial warmth will be evenly supplied over a sufficiently lengthy period.

When ready for use the manure should be of a light-brown colour, evenly fermented throughout, and entirely freed from the objectionably rank odour of ammonia noticeable when received from the stables. Its moisture-content should be such that it is adhesive, yet not so moist as to drip when pressed in the hand.

Although, in the absence of any better material, ordinary garden soil may be used for covering the beds, much better results may be expected if a good turfy loam is made up for this purpose. The top 2 in. of turf from a paddock which has been in grass for some years should be skimmed off and stacked in a square heap till the grass and root-fibres have decayed, a process for which at least six months should be allowed. In selecting a patch of turf to be used for this purpose it should be remembered that the oldest pasture land is usually the best, as the deeper the sole of turf the better will be the soil produced therefrom. The addition, in stacking, of a layer of well-rotted manure between each layer of turves will also greatly improve the quality of the soil.

OUTDOOR CULTIVATION.

For outdoor cultivation the prepared manure should be built in the form of a long heap about 3 ft. to 4 ft. wide at the base and sloping up to a ridge 12 in. to 18 in. wide at the top, neatly rounded off. As the work proceeds each layer of manure should be well trodden down until a firm compact bed is formed.

Fermentation will again set in, causing a renewal of the heat, which should be carefully watched with the aid of a plunging-thermometer (a thermometer mounted on a metal rod which may be forced into soil or other material to ascertain the temperature below the surface). When the heat has subsided to less than 80° F. the bed will be ready for spawning.

The spawn-cakes should be broken into pieces about the size of hen-eggs, and inserted about 8 in. or 9 in. apart all over the sides and top of the bed. The easiest and most expeditious method of planting the spawn is to raise a portion of the manure with the four fingers of one hand, place the piece of spawn-cake into the pocket thus formed, and replace the manure firmly round and over it again. The spawn-cake should be covered by about its own thickness of manure. The bed should now be covered over with straw, rushes, or other litter, which will conserve the heat and prevent the admission of excess moisture in wet weather. This material may be secured against wind by hurdles or stout manuka branches.

From the time the bed is spawned the plunging-thermometer should be inserted in various parts of the bed daily, and in the event of the temperature showing a tendency to rise above 80° this must be corrected by removing part of the covering, and, if necessary, making holes in the bed with a crowbar or stout pointed stick, to allow the vapour and superfluous heat to escape. On the other hand, the temperature should not be allowed to fall below 60° until the crop appears, and from then on at least 55° should be maintained until the entire crop has been harvested. With a little practice the beginner will find that extremes of temperature may be nicely controlled by reducing or adding to the covering. In mild weather a few inches only of litter may suffice, while on severe winter days 12 in. or 18 in. may be necessary.

About seven or eight days after planting the spawn the manure should be examined for signs of the mycelium running. This should now be observable in the form of white thread-like growths amongst the manure. In places where this is not visible the spawn should be renewed. If a satisfactory growth is in evidence the soil may now be added. This should be finely broken up with the spade and applied in a fairly moist condition to a depth of about 2 in., patting it down firmly with the back of the spade or shovel so that it forms a compact casing to the bed. Replace the covering of litter, guard against overheating as before, and in from six to eight weeks the crop should commence to make its appearance.

At no time should the beds be allowed to become dry, neither should rain be allowed to reduce them to a sloppy state. If it becomes necessary to apply water, this should be sprinkled over the litter through a fine rose and allowed to soak through. The water used should previously be heated to at least the temperature of the bed or a little warmer, as disastrous results are sure to follow the slopping of cold water over the growing mycelium.

In harvesting the crop, especially in very cold weather, only a portion of the covering should be removed at a time, and replaced again immediately the mature mushrooms are gathered, otherwise the bed may be unduly chilled.

INDOOR CULTIVATION.

Mushrooms can also be very successfully grown in a shed, a disused stable, or any building which affords suitable shelter from the weather. In fact, under such conditions, as a more equable temperature is maintainable, much labour is saved in handling the coverings. The general procedure is the same as for outside cultivation, except that the beds may be formed on the flat, and if the building is capable of being shut up fairly close the manure need not be of a greater depth than 12 in. or 15 in.

Many of the mushrooms sold on English markets are shipped from France, where, particularly around Paris, they are grown in huge quantities in the caves and underground passages of worked-out quarries; while in the gardens of the wealthier folks in England and the Continent specially constructed mushroom-houses are employed for the production of this delicacy all the year round.

While there is nothing to warrant the expenditure of a large sum of money in the erection of an elaborate structure for commercial mushroom-cultivation, for those who can procure the raw materials at reasonable cost a highly efficient substitute may be profitably erected as follows: Build the walls of good fibrous turves to a height of 4 ft., and about 18 in. to 20 in. in thickness. The width inside should be about 11 ft. to allow of a 4 ft. bed on each side and a 3 ft. central path. The length, of course, will be governed by the capital or the aspirations of the builder. A span roof may be cheaply formed of stout manuka-poles thatched with rushes.

Light is not necessary for the growth of mushrooms; in fact, whiter and finer heads are grown in darkness. The inside walls of a house such as described may also be made to give their quota to the returns obtained if planted with spawn all over and kept fairly moist by occasional sprayings with tepid water.

GATHERING AND MARKETING.

In gathering the crop, only matured heads should be taken at each picking, and the stem should be twisted (not cut) until it comes away with the root or underground stump. When the mushrooms are growing in clusters care should be taken to avoid disturbing the small specimens when picking the matured heads.

In marketing the crop, better prices will be realized if some attention is bestowed on the grading of the heads into equal sizes, cutting away the soiled portion of the stems, and packing the produce neatly and attractively in chip baskets.

FOOD VALUE OF MUSHROOMS.

While the mushroom may be regarded chiefly as a condimental substance, its food value is quite appreciable, comparing well with that of many other table vegetables. An analysis of the common mushroom given in U.S.A. Farmers' Bulletin No. 79 shows a protein-content of 3·75 per cent., and carbohydrates (starch and sugar) 3·5 per cent.

PERMANENT - PASTURE FORMATION.

TEMPORARY - FILLER EXPERIMENTS AT RUAKURA.

A. W. GREEN, Manager, Ruakura Experimental Farm.

THE main source of feed for stock in New Zealand being permanent pasture, any improvement in the quality or permanency of such pasture, resulting from methods adopted in laying it down, is clearly in the interests of every farmer, particularly if little or no additional cost is occasioned by the operation.

Pasture-formation experiments with the following objects are at present in progress at Ruakura:—

(1.) To determine the influence of temporary fillers on the permanent grasses and clovers which will ultimately constitute the permanent pasture.

(2.) To determine the value of temporary fillers as agents for reducing the weed-content in the permanent pasture.

(3.) To determine the comparative value of various temporary fillers for the provision of early feed.

Too much importance is frequently placed on immediate returns from young grass, and in order to secure these returns pasture is often ruined as regards permanency. A heavy seeding of Italian or Western Wolths rye-grass sown in a mixture of permanent grasses will provide excellent first feed, but there is nothing more detrimental to the growth of the permanent grasses. The strong growth of rye-grass, both in root and leaf, crowds out the slower grasses and clovers, with the result that when the rye-grass is finished there is nothing to take its place and weeds appear.

Certainly, by judicious stocking, the degree of influence of the temporary filler on the permanent grasses can be modified. Early feeding, preventing excess growth of rye-grass, may be practised; but if the pasture is fed with sheep the latter are severe on the clovers, preferring these to the stronger-growing rye-grasses.

On the other hand, it must be remembered that Italian and Western Wolths rye-grass as temporary fillers both have their advantages, and the greatest of these is the crowding-out of weeds. For this purpose they have no equal, if results already obtained can be relied on. The rate of seeding with these grasses would therefore form the basis of a most valuable experiment. Already small-plot trials are being conducted along the lines mentioned, and these should indicate what results might be expected from light and heavy seedings.

It will be recognized that in the endeavour to provide early feed without causing injury to the permanent grasses the choice of a temporary filler is of great importance. One which undoubtedly proves suitable is rape. In the Waikato district grass is usually sown in the autumn, and for this reason rape is frequently omitted. When spring sowing of grasses is practised farmers include rape in almost every mixture. The present trials at Ruakura indicate that rape is one of the most valuable plants to sow as a temporary filler when pasture is being laid down in autumn. Its habit of growth recommends it, for the large bulky top is carried on a thin stem well above the clover and permanent-grass plants. Its leaves thus act as a shade to the more tender plants, which is an advantage not to be overlooked, particularly in localities where frost is severe on clovers. Thousand-headed kale did not prove as valuable as rape in this respect, for the kale itself was affected by frost.

Cape barley, another plant used as a temporary filler, failed to give results equal to rape. The barley when sown in cultivated land as a catch-crop recovers rapidly after feeding off, but when sown with grass recovery is slow.

The area devoted to the experiment now under notice is 12 acres, of which 6 acres are fenced into six plots of 1 acre each. Over the remaining 6 acres duplicate plots were sown simply to determine the palatability of the various temporary fillers. These were not fenced separately, but eaten off together. As a result, sheep preferred rye-grass when first turned on, but soon left it for barley and rape, finishing these plants before returning to the rye-grass plots. Thousand-headed kale was left to the last. The whole area is situated in the centre of a 30-acre field, and for many

years prior to the commencement of this experiment the land has received uniform treatment. The erection of fences was delayed until a short time before stocking, in order to avoid variation when drilling.

The following are details of the conditions under which the pasture was established, and also results obtained up to the end of November last:—

October, 1915, to March, 1916—Land in rape fed off with ewes and lambs.

March 30 to April 4, 1916—Ploughed with double-furrow plough.

April 4 to 12, 1916—Cambridge-rolled, disked twice, tine-harrowed twice, and again rolled.

April 12, 1916—Manure applied (broadcasted) as follows: 1 cwt. Ephos phosphate, 1 cwt. Seychelles Islands guano, and 1 cwt. basic superphosphate, per acre.

April 12, 1916—Sown with the following mixture of grass-seed: 10 lb. cocksfoot, 6 lb. perennial rye-grass, 2 lb. timothy, 2 lb. meadow-foxtail, 1 lb. crested dogstail, 1 lb. *Poa nemoralis*, 4 lb. red clover, 2 lb. alsike clover, 1 lb. white clover: total, 29 lb. per acre.

This seed was sown broadcast with the drill, and distributed evenly over all plots. The seed of the temporary fillers was sown separately. The seed was covered by chain-harrowing, followed by the Cambridge roller.

The temporary fillers included in the experiment are prairie-grass, Cape barley, Italian rye-grass, Broad-leaved Essex rape, and Thousand-headed kale. Favourable weather conditions followed the sowing of the plots, and excellent germination resulted, excepting in the case of the prairie-grass, of which only a fair take was secured.

Details of the stocking are as follows:—

July 31, 1916—Stocked with sheep at the rate of twenty head per acre.

August 24—Stock removed.

September 11—Stocked with sheep at the rate of fifteen head per acre.

October 15—Stock removed.

November 2—Stocked with sheep at the rate of twenty head per acre.

The sheep were still on the pasture at the date to which this report is carried—viz., 29th November, 1916.

Careful records have been kept since the first date of stocking, and the live-weight gains already recorded from each plot are set out in the following table:—

Plot No.	Temporary Filler and Seeding per Acre.	Cost of Temporary Filler per Acre.	Total Live-weight Gains.
		s. d.	lb.
1	Control—nil	..	167
2	Prairie-grass, 14 lb.	5 7	179
3	Cape barley, 25 lb.	3 3	175
4	Italian rye-grass, 10 lb.	4 7½	263
5	Broad-leaved Essex rape, 2 lb. ..	1 8	379
6	Thousand-headed kale, 2 lb. ..	3 0	290

NOTE.—All plots were also sown with the grass-seed mixture previously specified.

It will be seen that rape has given the highest returns, and at the least cost per acre. Apart from the actual stock returns, it may be mentioned that the percentage of clover in the rape plot is higher than that of any other.

It is not likely that similar experiments conducted during other seasons would give much better returns than the rape in this particular experiment. The take was an excellent one, and on the date when sheep were turned in portions of the crop were higher than the sheep. In actual weight of crop the Thousand-headed kale would be a little more than half that of the rape.

There is no doubt that higher results might be expected from prairie-grass with a better take than was the case in the present experiment. The Italian rye-grass was a very fair average on which to base results.

It is worth noting that the weed-content is greater at the present time in the control plot than in any other, but the number of weeds in this plot are gradually diminishing as the permanent grasses and clovers develop.

AID TO SOLDIER SETTLERS.—AN APPRECIATION.

THE Honorary Organizer of the National Service League writes to the Editor, under date Masterton, 6th January, 1916, as follows:—

"Dear Sir,—We would like to express our appreciation and thanks to the officers of the Department of Agriculture for the splendid way in which they have treated returned soldiers who have started general farming and fruitgrowing. The experts have to our knowledge gone out of their way and taken a lot of pains to show the men anything they wanted, and no trouble has been too great for them. Their efforts amount to practical patriotism and are appreciated by the returned soldier.—Yours faithfully, F. NORRIS."

PEPSIN IN CHEESEMAKING.

SATISFACTORY NEW ZEALAND EXPERIENCE.

C. STEVENSON, Dairy Instructor, Manaia.

THE present general scarcity of rennet constitutes a serious menace to the cheesemaking industry of New Zealand, and, as there is a prospect of this shortage becoming more acute in the near future, it behoves all dairy concerns manufacturing cheese to as far as possible conserve their stocks of rennet.

With a view to affording the industry some assistance in this direction experiments have been carried out recently in Taranaki by officers of the Dairy Division in the use of pepsin as a substitute (wholly or in part) for rennet. The results of these experiments have been entirely satisfactory.

In order that a thorough comparison between the action of pepsin and that of rennet might be obtained, the same class of milk was used in each vat while conducting the experiments. This was done by dividing the milk as it arrived at the factory equally into each of the three vats used.

The milk in No. 1 vat was coagulated with pepsin, No. 2 vat with a mixture of pepsin and rennet, and No. 3 vat with rennet only. The pepsin was used at the rate of 2½ drams per 1,000 lb. milk, and the rennet at the rate of 3½ oz. per 1,000 lb. milk.

The curd in vats 2 and 3 was ready for cutting in thirty minutes, while that in vat 1, in which pepsin only was used, required ten minutes longer to firm sufficiently for cutting. No difference was observed between the curds of any of the vats as regards the development of acidity, or during the whole process of manufacture. The cheese from each vat was weighed, and the yield was practically the same in each case.

The loss of fat in the whey of the vat in which only pepsin was used showed a slight increase as compared with the other two vats. This was no doubt due to the slower coagulation of the former, and from experience gained while conducting these experiments, and in a number of trials made subsequently, it would appear that when pepsin alone is used its action is somewhat slow, even when the quantity used is increased.

For this reason I strongly recommend cheese-factory managers to use a mixture of pepsin and rennet. The difficulty referred to will then not be experienced, and good results should be obtained throughout. Sufficient pepsin, at the rate of 2½ drams per 1,000 lb. milk, should be used to coagulate half the milk in the vat, and sufficient rennet for the remainder. Owing to the varying strength of rennet it is, of course, impossible to fix the amount required per 1,000 lb. of milk, but factory-managers who are using the same quality of rennet daily will have no difficulty in this respect. After dissolving the pepsin the liquid should be mixed with the rennet, and added to about half a bucketful of cold water before being stirred into the milk.

As weighing the pepsin takes some little time, I would recommend the use of a measure, which could easily be made to hold any quantity from 2½ drams upwards. The pepsin should be dissolved in about twenty times its own weight of water. The water should be added in small quantities, and the mixture constantly stirred. Water at a temperature of 100° to 105° F. has been used for this purpose previously, but I find that the spongy pepsin now on the market will dissolve easily in cold water. In any case the temperature of the water used must not be higher than 105° F., as pepsin dissolved in water at very high temperatures will quickly lose its strength. A fresh lot of pepsin should be dissolved for each vat. This is very important, as pepsin solution held for any length of time becomes so weak as to be practically useless. In order to ensure a thorough dissolution the pepsin should be prepared fifteen to twenty minutes before the vat is ready to set.

As the dry pepsin absorbs moisture very rapidly, care must be taken not to expose it to the atmosphere any longer than is absolutely necessary. The airtight tins in which the pepsin is supplied should be tightly closed after each lot is used, otherwise the pepsin will form into hard lumps and become quite unfit for use.

The quantities of pepsin recommended for use in these notes refer to pepsin of a strength of 1 : 3,000.

In addition to the fact that the use of pepsin will greatly assist in overcoming the difficulties brought about by the shortage of rennet, pepsin is, at present prices, considerably the cheaper article of the two. Spongy pepsin is now quoted at 18s. to 19s. per pound, and rennet at £3 to £3 5s. per gallon. As 1 lb. of pepsin is practically equal to 1 gallon of rennet, it will readily be seen that a considerable saving can be effected at the present time by the use of pepsin.

The cheese made in the experiments referred to above is at date of writing (end of December) fifteen weeks old, and after manufacture has been examined at intervals of fourteen days up to the present time. The cheese is of good quality and very well matured. No difference whatever is noticeable between the cheese made with pepsin and that made with rennet.

Previous to the carrying-out of this experiment there was some doubt as to whether the use of pepsin would not have some injurious effect on the cheese during the maturing process. The results, however, have proved conclusively that no apprehension need be felt in this direction, and that cheese can be made of as good quality with pepsin as that made with rennet.

NOTE BY THE DIRECTOR OF THE DAIRY DIVISION.

The Dairy Division of this Department is greatly indebted to Mr. J. A. Ruddick, Dairy and Cold Storage Commissioner of Canada. for his kindness in forwarding full information regarding the experiments carried out at the Finch Dairy Station in that Dominion, in connection with the use of pepsin in the manufacture of cheese. These experiments were conducted in May of last year (1916). When found to be successful bulletins were issued by Mr. Ruddick describing the method of procedure, and giving other valuable information to dairy-factory men. Copies of this printed matter were sent to us, enabling the officers of the Dairy Division to introduce pepsin as a coagulating agent at many of the dairy-factories without loss of time, and in that way the shortage in the supply of rennet has been in part overcome.

The latest advice from Canada is to the effect that the cheese-manufacturers there are now depending very largely on the supply of pepsin to replace rennet. Mr. Ruddick assures us that so long as the right material is used and close attention paid to its application in accordance with the prescribed method it is found quite satisfactory for the purpose.

In order to ensure the best results it is recommended that pepsin and rennet be used in proportionate quantities for each vat of milk.—*D. Cuddie, Director of Dairy Division.*

A method of dealing with the small-bird pest that has often been proved to be very effective is to fire shot at night into trees where the birds are sheltering in large numbers. The startled birds fly out, lose their way, beat about, and finally die of exhaustion—practically killing themselves. Dark, stormy nights are best for carrying out the operation.

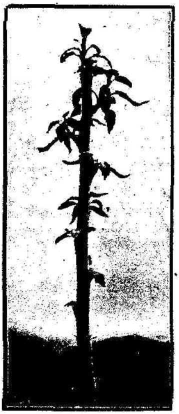
SOUR-SAP IN FRUIT-TREES.

W. C. HYDE, Orchard Instructor, Nelson.

THE accompanying photographs and a few notes on the diseased condition known as sour-sap which is affecting trees to some extent in the apple-orchards of the Dominion should be useful to growers who are not familiar with the conditions. While the trouble is a serious one and its sudden appearance very disappointing, once it is identified steps can be taken to stop its ravages with, usually, every prospect of success.

As shown by the figures, sturdy trees, to all appearances in perfect condition when pruned, make a few weeks' growth in spring and then fail, the partly developed leaves and flowers gradually withering, and the tree gradually dying *from the roots up*.

A close examination of the tree will show the foliage to be normal as far as it is developed, and the bark of the limbs and trunk in bright and sound condition, often right down to the crown of the roots. If, however, the tree is dug up at once the ground is usually found to be in a very wet, sour condition, the roots discoloured and waterlogged, the brown discoloration extending well above the crown and still spreading upwards, with the sap at this point in a highly fermented state and the formative tissue completely disorganized.



SOUR-SAP.
Close view of a leader in Fig. 2 (next page).

As before suggested, the affection is due to the wet condition of the soil, and is more prevalent on soils of a rather heavy retentive nature, particularly in places where flood-water gathers and the heaviness of the soil prevents a free passage. The mechanical condition of such a soil demands much more consideration than it often gets, for to travel over it and work it while wet is to directly court the affection here referred to. On this class of land, in districts with a rainfall of anything like 40 in., the most successful orchard practice has been to sow the land down in autumn with a cover-crop and not to plough again until the spring is well advanced.

NOTE.—This subject was also dealt with in articles entitled "Dying of Young Fruit-trees," by A. H. Cockayne, and R. Waters, published in the *Journal* for December, 1915, and February, 1916, respectively.—EDITOR.

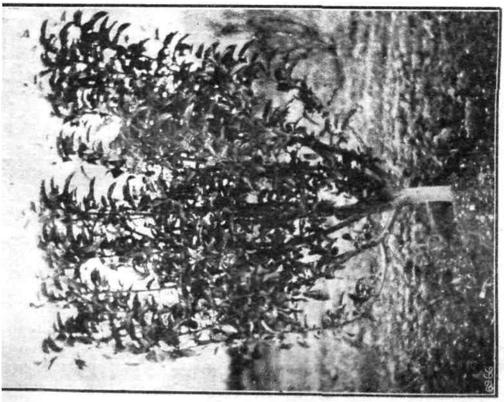


FIG. 1. AN APPLE-TREE IN NORMAL CONDITION.

Photo taken second week in November, the weather being rather windy.

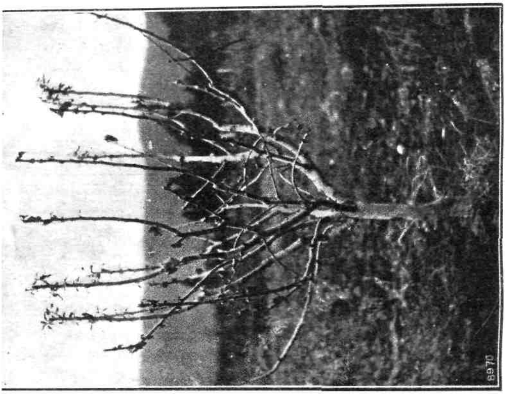


FIG. 2. A FIVE-YEAR-OLD APPLE-TREE AFFECTED WITH SOUR-SAP.

Photo taken at the same time and under the same conditions as Fig. 1.

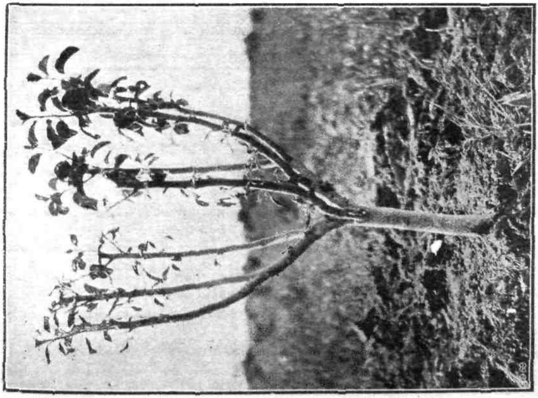


FIG. 3. A THREE-YEAR-OLD APPLE-TREE AFFECTED WITH SOUR-SAP.

Photo taken at the same time as the preceding ones.

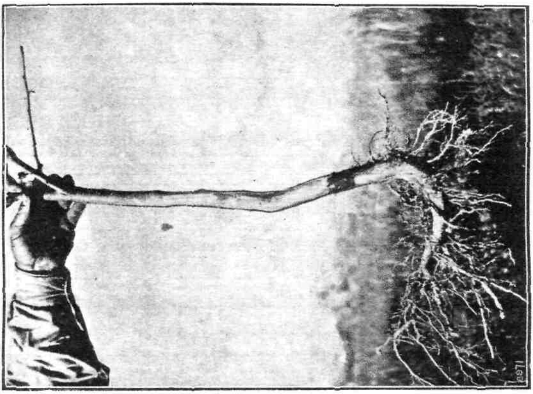


FIG. 4. AN APPLE-TREE AFFECTED WITH SOUR-SAP, LIFTED.

The trunk and roots are peeled, showing the brown discoloration of the roots and crown.

LEGUMINOUS PLANTS AND THEIR USES.

Lecture delivered by MR. J. W. POYNTON at a Meeting of the Manawatu Philosophical Society, Palmerston North.

THE leguminous — that is, pod-bearing — orders of plants comprise more than six thousand distinct species, and are of all sorts from tiny plants to lofty forest-trees. The best known are the clovers, peas, beans, brooms, gorse, lucerne, and the Australian wattle. Our clianthus (parrot-bill) and kowhais are native legumes. The behaviour of some of the leguminous plants in the precautions taken to obtain favours in the struggle for existence shows a sort of dawning consciousness or intelligence. The peanut, a legume, actually plants its own seed. Gorse has remarkable arrangements for spreading its ripe seed and protecting the young shrubs from browsing animals.

Legumes are the only cultivated plants that get nitrogen direct from the air in co-operation with bacteria, and this habit gives them a position of great importance in agriculture. Nitrogen is a most important element in relation to plant and animal life. It is difficult to get it to unite with other elements, being quite unlike oxygen in this respect. The air is composed mostly of these two gases, nitrogen being the most abundant, nearly four-fifths of the atmosphere being composed of it. As about 15 lb. to the square inch is the weight of the atmosphere on every part of the globe at sea-level, it will be seen that upon each acre of land and sea there rests more than 330,000 tons of nitrogen. Notwithstanding this plenitude, nitrogen in its various forms is very expensive as a manure. Under certain conditions little germs in the soil cause it to join with other elements, and plants can then use these resulting compounds.

When nitrogen does combine with other substances it readily gives up such unions in most cases. This instability of its combinations is the basis of all the high explosives. Dynamite, lyddite, guncotton, trinitrotoluol, gunpowder, are all nitrogen compounds, and owe their terrible powers of destruction to the almost instant disengagement of the fickle nitrogen atoms from others, and consequent formation of large volumes of gases.

The basis of all animal and vegetable life is a jelly-like substance called protoplasm, a nitrogen-compound. Most of our flesh is proto-

plasm, and all living creatures need a constant supply of it, or what it is composed of. Animals cannot make it out of non-living matter, and they must depend on plants to do this for them; therefore the orders of plants which can most readily manufacture these essential food substances become highly important, and the unique power of legumes to do this work gives them first place in food-production.

Nitrate of soda used as a fertilizer is got mainly in Chile, where it exists in vast beds. Their origin is unknown, but it is believed that, like saltpetre (nitrate of potassium), the beds were due to bacterial action. In hot countries like India, where decomposing organic matter containing nitrogen and potash come together, saltpetre is formed, and probably the nitrate beds of South America came into existence in a similar way; but instead of potassium, sodium is the metallic base there. The extreme dryness of the climate has preserved it from being washed away, as the salt is very soluble. From these valuable beds not only is the fertilizer drawn, but the principal source of commercial nitric acid is due to them. In making high explosives nitric acid is most essential. The ability to draw freely on these deposits will probably later on be the deciding factor in the Allies' favour in the present war. Nitric acid can be made from the air, but it is a slow process, and it cannot be produced fast enough in that way to keep pace with its enormous consumption in such battles as those of Verdun and the Somme.

As far back as the time of Virgil it was noticed that wheat and other crops grew much better after peas and clover. The reason for this was not known until recently. If you will dig up, without breaking the roots, beans or lupins, you will see on them little warts or lumps, hundreds sometimes being visible on a single root-bunch. These warts are part of the root-substance, but inside of them, like seeds in a passion-fruit, there are thousands of bacteria which get nitrogen from the air in the soil, and change it into compounds that can be directly used by the bean or lupin. In soils rich in nitrogen these beans or other legumes will have very few tubercles on their roots, but in others the plant and the microbe join forces to obtain this essential to their existence. The plant nourishes the germ, and receives in exchange the all-important nitrogen. It is a remarkable example of co-operation, one of the most interesting partnerships in nature and of the utmost importance to mankind. Other plants such as wheat, cabbages, and potatoes cannot thus get nitrogen direct from the air. It must be already in the soil in the form of nitrates before these crops can use it.

Leguminous plants, on account of their containing so high a percentage of nitrogenous compounds, known generally as protein or proteids, are most nutritious. All farmers are aware of the nutritive value of clovers, peas, beans, and lucerne; but few of us fully realize how highly sustaining peas and beans are as a food for human beings. Meat is largely made up of water. Pound for pound, peas or beans contain more than twice as much assimilable nitrogenous material as flesh-meat does. If this fact were only more clearly recognized we would rely for our nitrogenous food more on plants than animals, and the price of meat, which is steadily rising and must continue to rise in future, would not concern us so much. It would probably be better also from a health point of view if we ate less flesh-meat and more vegetable protein. The German people learned this long ago, and the staple ration of the German army is largely made up of a sausage or broth-block containing pea or bean meal.

It is curious how this originated. About 140 years ago Bavaria was infested with beggars who were a curse, and the king determined to rid his country of them. He handed the problem over to Count Rumford, a remarkable man, a Scotchman, whose family name was Thompson. Rumford used the police and army to seize and place under restraint all the beggars simultaneously. He experimented on them with various meat and non-flesh diets. After long trials, which were most carefully recorded and the results accurately analysed, he discovered two kinds of soup or broths which gave the greatest amount of energy and satisfaction, and the proteid foundation of each was peas. So cheap were these broths that enough for 1,200 meals could be made for £1 15s. 3d. in one case, and £1 7s. 6d. in the second—about ⅜d. each in one, and but little more than ¼d. in the other. The second had potatoes in it, but so great was the prejudice against potatoes in those times that in order to avoid a "hunger-strike" they had to be introduced into the broth surreptitiously. Even at present prices such meals can be supplied at less than 1d. each. The story of Rumford's successful dealing with the vagrant pest is a fascinating one, worth careful study by social reformers, but we are only concerned with his discoveries in dietary. Many of the reformed alms-seekers afterwards became prosperous citizens, and several wrote Rumford for the recipes of the broths, which they had in their enforced restraint grown to like.

The want of liking for peas and beans is probably due to our ignorance in cooking them. In Rumford's broths the peas were boiled for three hours, and treated with vinegar. The continued boiling would cause certain volatile substances to evaporate, and

the acetic acid of the vinegar would neutralize any alkalis. Our karaka berry or nut has volatile poisons which the Maoris knew how to get rid of before eating the nuts. The cassava-root, so much used for food in South America amongst the aborigines there, is also very poisonous, but is rendered harmless by cooking. The remarkable physical vigour of those peoples whose diet is largely based on peas is a striking testimony to their nutritive value, apart from what chemical analysis shows.

Peas contain as their protein an organic compound, legumin, chemically similar to casein in milk, amounting to about one-fourth of their weight. An excellent cheese can be prepared from it almost indistinguishable from skim-milk cheese, and free from dangerous micro-organisms. This is the recipe: Digest pea powder or meal in warm (not boiling) water for two or three hours, strain through cloth; allow to settle, when starch-grains fall to the bottom. Pour off the liquid gently into another vessel; from this precipitate the legumin with a small amount of acetic acid or strong vinegar.

Experiments in the preparation of peas and beans for human food offer a promising field for research. Little or nothing has been done in this since Rumford's time. Some of our girls who are studying for the Home Science degree of our University might well devote themselves to it. A thesis on this subject would be much more interesting to the writer and readers than the dry and technical papers appearing in the "Transactions of the New Zealand Institute" as theses of graduates.

The value of leguminous plants as sources of human food is only one of their virtues. The power to get nitrogen direct from the air into their structures has a most important bearing on the fertility of soils. When the plant-tissues decay, their nitrogen-compounds, or others resulting from their decomposition, remain in the ground, and this is the reason for increased yields of other crops after one of legumes. The amount of such compounds is considerable, and if applied with intelligence the fertility and quality of poor soils can be much improved by a system of legume-culture.

For example: In North Auckland there are great areas of poor clay gum-land that will not grow grass well even with manures. It has been found that with dressings of basic slag (which contains lime and phosphorus) a legume, *Lotus angustissimus*, will grow luxuriantly on these clays. I saw one paddock of under 4 acres that kept seventy ewes and forty lambs from 3rd November to 15th January. They were in splendid condition, and the feed was not all eaten. Another paddock, only 17 acres in area, a mile or so away, similarly treated, kept for some months thirteen

horses and a milking-cow. On the other side of the road a paddock had been heavily manured with the usual manures, but it was painfully bare. Grass had been sown in it. The poverty of the soil was indicated by the fact that a row of *Pinus radiata* along the road boundary of the 17-acre paddock was not more than 15 ft. in height although planted about twelve years. I passed the first-mentioned paddock four times in February, 1915. Nearly all the animals were lying down apparently satisfied, and all were fat and contented-looking.

The lotus gives a good yield of hay. Horses and pigs as well as cows are very fond of it. The drawback to it is that it ceases growing in the dry weather, but as it makes such nutritious and palatable hay, this lean part of the year can be got over by reliance on the hay until the autumn rains come.

These results have been obtained at Dairy Flat, on the east side of the northern peninsula, but on the other side, near Dargaville, similar good results have been got from slag and *Lotus angustissimus*. In August last I was there, and was furnished with striking proof of what can be done with lands that for growing grass are almost useless. In both places it is believed that after a few years the soils will be so enriched with nitrogen from the legume that grass will take. But even if it does not, we can see how very important this legume is for a large part of New Zealand.

In other parts of the country there are soils that may respond to like treatment—soils that cannot be made to readily grow grass. To the east of Lake Taupo there are the great Kaingaroa Plains, an area of about 2,000,000 acres. Analyses of the soils of these plains at different places show that with the exception of nitrogen they contain sufficient (and in some cases more than sufficient) lime, phosphorus, and potash to make good soils. They are, however, practically desert areas, the pumice-dust supporting nothing but stunted tussocks and attenuated shrubs, the ash-like soil being visible everywhere. There can be no doubt that they are areas covered with volcanic dust from some great eruption, perhaps from Lake Taupo as the crater.

In 1903 I found on a spur of Tarawera a patch of clover about 20 ft. square. No grasses or other vegetation grew amongst or near it. It was splendid clover, growing on the pure dust from Tarawera eruption, which at that place was many feet in depth. At the destroyed Wairoa Village I noticed clover of immense size growing among wattles where there was a couple of feet of dust. These facts show that legumes will grow on this dust, and although grass will not do so the dust-covered areas may, like the clay lands,

be made to yield abundantly independent of grasses. Afterwards, when the requisite nitrogen is supplied by means of legumes as carriers, the nature of the soils will be changed.

How soils can be changed by legumes may be especially well seen near New Plymouth. The barren sands there grow lupins luxuriantly, of almost jungle size and thickness. On looking under them you will find a great thickness of fallen leaves and pods, forming a splendid mould which must be very rich in nitrates. In one place I roughly estimated the weight of stalks, leaves, and pods—the pods being amazingly abundant—at 110 tons resting on each acre. To reclaim such soils would be an easy matter. The way sands are being allowed to cover good soils in New Zealand along the Manawatu coast and in the far North is almost a crime. In Tasmania it has been found that marram-grass and melilotus (a legume) give good results—the marram to bind the sand, and the legume to blacken and enrich it with mould.

The world needs vast quantities of oils, animal and vegetable, in addition to proteids. Even vegetarians require them. In India the non-meat eaters rely mainly on ghee, which is clarified butter; in Italy the oil consumed is olive-oil; in China, fish-oil and fat pork. But everywhere the demand is overtaking the supply. The remarkable increase in the consumption of artificial butter shows this. At first it was atrocious stuff, but it has come to stay. It can now be got without animal fats, made largely from African palm-oil and coconut-oil, and the vested interests concerned in its production will use all suitable oils to be found. In the coconut we have an immense reserve of a nutritious and wholesome oil. It is the largest nut, and its dried flesh contains nearly 50 per cent. of oil. We have not realized its importance as a source of wealth. In 1912 the value of the coconut-palm products was £70,000,000—that is, equal to the whole of the world's gold-production a few years ago. The Germans, with their usual foresight, foresaw its coming importance, and had almost a monopoly of the trade in its products before the war. It has been found that the coconut-palm can be grown inland under favourable conditions, so there is a great future before this valuable tree; but, like the African oil-palm (an altogether different tree), it will grow only in the tropics. The great want is an oil-producing plant that will grow in the temperate zones, and we have in a legume—the soya bean—more than a promise of this. Before the Russo-Japanese war this bean was hardly known in Europe except to botanists, but is now imported from Manchuria, &c., in immense quantities. The percentages of proteid and oil in it are remarkably high. The oil is of a peculiar nature, in some things resembling butter-

fat, and it will probably be used as an ingredient in oleo-margarine. The bean is said to be largely eaten by Eastern peoples, but Europeans have not yet acquired a taste for it.

Useful legumes are not all known. In South America there are many members of the family still untried, some of them with pods of immense size. Monkeys and birds have been observed by travellers feasting on them, and these legumes may yet be domesticated. In the Solomon Islands huge beans are eaten by the natives, and there are also edible ones of great length and girth in New Guinea. Amongst the Javanese, and also in Japan, there are useful beans that have not yet been introduced to us. If these are not palatable to us they can be improved by selection, as has been done with other vegetables. Those legumes we have are being constantly improved by nurserymen and plant-breeders. We can now get peas with ten seeds in the pods. The ancestor of our pea, when first domesticated, produced only three small seeds to each pod. The soya bean is small and has only three seeds to each pod at present, but it will be bred up as its cousin the pea has been.

It is astonishing what can be done by plant-breeders in steadily changing for the better useful plants. Thus, the Illinois Experiment Station succeeded in six years in increasing the amount of oil in Indian corn from 4·7 per cent. to nearly 7 per cent. This was to get a kind of corn rich in oil. On the other hand, corn with a lower oil-content was desired as a feed for hogs, as this produced harder and firmer bacon. The breeders of the station proceeded by selection to decrease the amount of oil, and reduced it to less than 2 per cent. It was desired to produce for food a corn with a higher proteid-content than usual, and in six years they raised it from 10·92 per cent. to 16 per cent.; and for the production of starch, where a lower proteid-content was desirable, it was reduced to 6·66 per cent. (see "Experiments with Plants," by W. J. V. Osterhout, Ph.D. p. 437 *et seq.*).

There are two ways in which plant-breeders can further specialize the pea: by producing a salad-plant from it, and making it of greater nitrogen-content, high as it now is. Plants of the legume orders vary very much in the amount of protein they contain, and in the number of their root-tubercles. These two qualities are hereditary, and can be, like the milking-strain in dairy cows, very much intensified by selection. By carefully choosing for breeding those plants which have much protein and others which have the greatest number of tubercles, highly specialized kinds can be got of much greater value as food or fertilizers than the present average. Regarding the necessity for a leguminous salad, before the legumes produce their pods there is much more nitrogen in

the leaves, stalks, and roots than afterwards. Before the percentage would be about 7, afterwards 2½ per cent. A salad of leaves with this amount of nitrogen (7 per cent.) would be most nutritious. All our salad-leaves are poor in protein. Pea-leaves are very tender and juicy, and plant-breeders could soon give us a variety with large leaves and attractive flavours. Some other legume, such as the lupin, may be found better than the pea for the fixing of nitrogen, but the pea is already far on the road to becoming a perfect salad-plant.

A very valuable legume, little known in this country, is the carob-tree, which should grow well in the warm parts of the Dominion. Cattle, sheep, pigs, horses, fowls, and goats eat its pods, which are highly nutritious. It is a great source of wealth to the people of the Mediterranean. Some seeds obtained from Malta and Cyprus have recently been distributed throughout the Auckland Province, and more are now being obtained for distribution next spring.

Fortunately for our race, which tends in general to increase beyond its means of subsistence, we have in these wonderful leguminous plants an almost inexhaustible reserve of food materials, and also a perennial source of nitrogen for the world's soils.

LUCERNE-GROWING IN NORTH OTAGO.

CALIFORNIAN THISTLE CONTROLLED.

S. M. TAYLOR, Fields Inspector, Oamaru.

WHAT can be achieved in the way of growing lucerne in North Otago and at the same time dealing with the Californian thistle is well demonstrated in a 17-acre paddock on the farm of Mr. Thomas Perry, of Totara, near Oamaru. This paddock, which was very bad with the thistle, was sown down with lucerne without either lime or inoculated soil two years ago. Notwithstanding the very severe treatment it received through being grazed by sheep during its first year's growth, and the prolonged drought of last season (which is considered by the oldest residents the most severe experienced in the history of North Otago), the result has been most successful, and clearly proves that lucerne can be grown to advantage in this district.

The land was cultivated as follows: Ploughed in May, 1914, disked, and left until the spring; ploughed again in October a second time, turning over on this occasion Californian thistles

3 ft. high; disked, tine-harrowed, and rolled; sown through the rape-canisters of the drill lengthwise (up and down the paddock), then sown across paddock, sowing 16 lb. of Hunter River seed per acre; and finally chain-harrowed and rolled. On account of so much fat-hen and Californian thistle appearing six weeks after sowing, the growth was cut and left as a mulch. At the end of the year the lucerne was cut and made into hay. After this, owing to the severe drought and the owner being hard pressed for feed, 240 ewes and 275 lambs were turned on the paddock and kept on until May, 1916, when they were taken off and the paddock spelled for about six weeks. On 14th June more sheep were turned on, and grazed the paddock until 14th September, when they were taken off and field shut up until 28th November. It was then cut for hay, producing a very heavy crop, the cut averaging 40 in. in length, and some of the stems in hollows measuring 53 in.—truly a wonderful growth for two months.

The writer, with Mr. Perry and two others, went over the field two days after it was cut, and it is safe to say that we did not find fifty Californian thistles in the whole field, and these were very puny and feeble-looking. On New Year's Day I visited and walked over the field again, and failed to find any thistles. Since being cut for hay on 28th November the lucerne had grown 22 in. in height, the field being a picture to look at.

After watching this paddock I am quite satisfied that a good stand of lucerne will kill out Californian thistle, for no area could have been more badly infested than this one was two years ago. The field is well worth a visit from any farmer.

As showing his faith in lucerne for North Otago, Mr. Perry has recently sown another 11 acres, which is coming on well.

AGRICULTURAL COLLECTIONS.

In connection with the proposed augmentation of facilities in agricultural education a need will no doubt be felt for suitable illustrative collections. Such collections might be divided as follows:—

(1.) A central agricultural museum comprising collections illustrating veterinary physiology and pathology, plant pathology, agricultural zoology and entomology, and agricultural geology. In addition, there should be a trades section illustrating the grading and manufacture of the staple products.

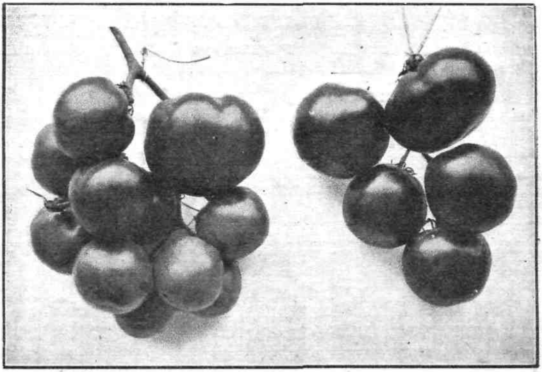
(2.) Small local collections illustrating the weeds, seeds, fungus pests, and life-histories of important insects. These could be housed in wall-cases in the local library or other public building.

(3.) Small grants might be made towards the cost of forming similar teaching collections in those public schools which make agricultural science a specific subject.—*W. R. Forbes, B.Sc., Auckland.*

TOMATO-GROWING WITHOUT WATER.

S. F. ANDERSON, Horticulture Division.

IT is the custom in growing tomatoes under glass to treat the plant as one requiring a large amount of manure and copious watering, and too often a close atmosphere. This method of treatment has been copied by one grower from the other throughout the country,



TOMATOES GROWN WITHOUT WATER AT ARATAKI.
Truss on left, unthinned; on right, thinned.

with the result that few houses can be found where fungoid diseases are not giving much trouble. When once such diseases make an appearance their spread is so rapid that it is almost useless to attempt complete control. In many cases the grower is thankful if he can mature the first truss or so of fruit before the plants die. In our climate, from the North Cape to south of Christchurch, the tomato may be stated as a hardy outdoor plant for nearly five months in the year. We do experience bad years for them and

other plants occasionally, but under glass bad weather conditions should not so much matter.

With a view to demonstrating in a practical manner that the conditions generally given to tomatoes under glass are capable of considerable latitude, Mr. W. H. Taylor, Manager of the Arataki Horticultural Station, has during the present season conducted an experiment of which the following is a brief account.

The variety used was Stirling Castle. This is not a favourite tomato, but was the only one available at the time the experiment was initiated. The plants (raised under glass) were obtained from another place where tomatoes are largely grown under glass, and were more or less diseased when planted for the purpose of the experiment. They were planted in a house that has glass sides to the ground. The situation of the house can be described as hot and dry. It is further robbed more or less of moisture by an asparagus-bed, a rhubarb-bed, and other garden crops growing outside the end and side of house. The soil of the house to a depth of from 4 in. to 5 in. was as dry as powder. The plants were put in on the 6th September, without any water or puddling; no manure was given to them; the soil of the house was not watered, neither was any spraying done. Yet nearly full-coloured fruit was on some of the plants at the end of November. The plants were then about 4 ft. high, the growth being short-jointed and strong, with four trusses of fruit on nearly all the plants, and others developing. There was no sign of any disease, not even the curling or closing-up of the lower leaves so common in nearly all tomato-plants grown indoors. The fruit ripening was of a fair average size. These conditions were maintained as the season advanced, the plants being perfectly healthy and still bearing fruit when again seen by the writer at New Year. Two of the trusses are shown in the accompanying photograph.

The demonstration shows that by following this entirely different method of growing tomatoes under glass the condition of a moist atmosphere, which is the chief cause of fungoid disease, is removed. Here lies the strong point for the consideration of the grower. By not giving water to the surface soil of the house the roots are encouraged down into the deeply worked soil. The plant then in its effort to obtain the necessary moisture for its existence does not, it is contended, produce that soft, sappy condition that invites disease when subjected to rapid changes of draught and heat. The supply of air is most important. It should always be admitted by ventilation *above* the plants, never low down.

CONTROL OF PENNYROYAL.*

EXPERIMENTS AND CONCLUSIONS.

J. W. DEEM, Fields Supervisor, Wanganui.

DURING the past two years a number of experiments in the control of pennyroyal have been carried out by the Department at Awahuri, near Feilding. Several proprietary weed-destroyers, sheep-dips, home-mixed arsenic and soda, kerosene, and dressings of salt were tried. Some work was also done in draining and liming. From the experience gained the following conclusions may be stated as fairly definite :—

(1.) That any poisonous weed-destroyer will kill pennyroyal when evenly sprayed over the ground. Non-poisonous sprays and kerosene burn the weed, but it comes away the next season as strong as ever, the only effect being to prevent the season's seeding.

(2.) That arsenic and caustic soda at the rate of 1 lb. of each to 20 gallons of water is quite as effective as any of the proprietary weed-destroyers used.

(3.) That salt when applied in dry weather at the rate of 2 tons per acre is as effective as poisonous sprays.

(4.) That all sprays, or dressings with salt, should be applied to the weed standing, during dry weather, and when the plant is just coming into flower.

(5.) That liquid dressings can be more easily and evenly applied than dry dressings. Salt, on the other hand, has the advantage that stock need not be removed after it is applied, whereas if a poisonous specific is used stock must be removed until after a good rain.

(6.) All these applications have a detrimental effect on clovers, but, with the exception of salt, they appear to have no bad effects on grass. The crop of hay this year was heavier on the sprayed portion than on the unsprayed area, and at first sight it appeared as if the spraying had had a stimulating effect on the grass, but this is accounted for by the absence of pennyroyal. The grass on the salted area was about equal to that on the untreated area.

(7.) That it is not possible to clear pennyroyal right out of the pasture in one season by spraying. In practice it is found that 90 per cent. of the standing weed can be killed the first year and the other 10 per cent. the second year, but it will also be found that seed that has been accumulating on the ground for years will germinate as conditions become favourable, and it will

* *Mentha Pulegium.*

take several years to finally clear the ground. The cost of spraying after the first year will be small in proportion, probably only 10 per cent. of the first year's cost.

(8.) That liming and draining will greatly reduce pennyroyal by sweetening the land and bringing about a stronger and more vigorous growth of grass, and by reducing the acidity of the land and making it less suitable for a plant like pennyroyal, which revels in sour soil.

(9.) Experience has shown that 360 gallons is a fair average of liquid required to spray an acre of pennyroyal, and that most of the proprietary weed-destroyers require to be used at a strength of 1 in 20. The cost of the material of the several destroying agents used thus works out per acre as follows:—

Proprietary weed-destroyer, 18 gallons at 4s., £3 12s.

Arsenic and soda: arsenic, 18 lb. at 6d., 9s.; caustic soda, 18 lb. at 10d., 15s.: total, £1 4s.

Salt, 2 tons at £4, £8.

To this has to be added cost of applying and cartage, which for a liquid spray will work out at about 10s. per acre if applied by hand, and about 3s. if put on with a machine sprayer; this is provided water is reasonably close. From the above summary it *will be noted that arsenic and soda is a long way the cheapest,* while salt is more than double the cost of the proprietary mixtures.

In dealing with pennyroyal I would not recommend the use of sprays or salt except where the weed is in small patches; there they can be used to great advantage. The economic method of treating land badly infested with pennyroyal is to drain, subsoil, and lime the land, fallow for a season, and follow up by quick-growing cover-crops for a year or two, when the field may be put down again to pasture. Care must be taken to grow crops that can be harvested before the pennyroyal ripens seed, which is generally late in January and February. On pasture land that it is not convenient to plough, and where there is still a fair sole of grass, pennyroyal can be greatly controlled by top-dressing with lime or basic slag, closing up the paddock early in the spring, and allowing the grass to grow right up to the New Year before stocking. By this means the bulk of the weed will be smothered. I have seen pastures greatly improved by this method.

In mixing arsenic and soda, take 1 lb. each of arsenic and soda, and 1 gallon of water, and boil for twenty minutes. This can be diluted 1 part in 20 of water as required. Gloves should be used to prevent the soda getting on the hands.

importa.

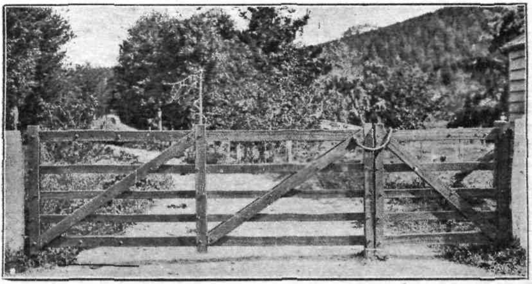
thanks of the Department are due to Messrs. Bennett Bros.

plants, neve *of the land at Awahuri on which the experiments were*

A COMBINATION FARM-GATE.

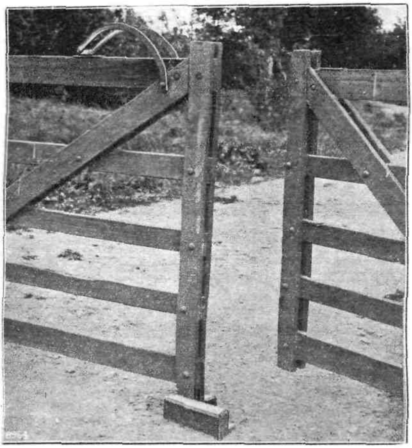
J. D. RITCHIE, Wellington.

A USEFUL style of double gate is shown in the illustrations herewith. The smaller gate, about 4 ft. wide, serves for bridle and foot traffic, while the larger one, 10 ft. wide, does for the ordinary wheeled traffic. It is, however, necessary at times to have a wider opening to allow of the passage of farm implements, or for other special purposes, and in such case both gates can be thrown open, thus giving a clear space of 14 ft. The photos show generally how the gates are hung. There is no centre-post, only a block sunk in the ground. The larger gate is held in position by resting in a small slot provided in the block, the slot being about 3 in. deep and



THE DOUBLE FARM-GATE.

just sufficiently wide to fit the end of the gate. To enable the gate to be lifted in and out of the slot the eyelet of both hinges is made oblong, the top one being, say, 2 in. and the lower $1\frac{1}{2}$ in. long. As indicated, this allows the gate to be lifted up the necessary height to clear the block. The gate should be hung so that the block takes the weight and no more. The small gate is hung in the ordinary way and closes up against the block, no slot being necessary for it. It will be seen that the catch comes well down over the gates, thus keeping both in position when shut. A small piece of iron (striking-plate) should be put on the top bar to take the catch, otherwise the latter will cut into the wood when thrown over. (See also illustration on next page.)



BLOCK ARRANGEMENT AND CATCH OF THE DOUBLE GATE DESCRIBED ON PRECEDING PAGE.

THE BLACKBERRY NUISANCE.

MR. G. W. Tiffen, of Cambridge, Waikato, sends the following notes on the blackberry question :—

Some forty years ago, when settlers little thought that the blackberry had the habit of spreading extensively, I knew a sheep-farmer who, thinking that a few of them would be useful for jam-making, planted some on his property in Hawke's Bay. Learning several years later that the plants were likely to spread, he decided to destroy them. It was found, however, that, for some unexplained reason, the plants had not spread at all (apart from the original bushes). Knowing the blackberry as I have known it since, I have often wondered why in this instance it did not spread. The soil in which it was planted was a stiff retentive clay, which may have accounted largely, though probably not entirely, for its inability to do so. In casting my mind back over these intervening years I have the recollection that the bird-life was at that time vastly different to that of the present day. Although the whole place was literally teeming with birds of various sorts, the only imported ones found in the locality at that time were turkeys, a few pheasants, and a few Australian brown quail; while about the same period the skylark made its advent to that part of the country, being rapidly followed by

the sparrow and other imported birds. At the present time native birds are about as rare there as the imported birds were formerly. Indeed, some of the native birds that were to be found there then are now altogether extinct. In considering these things it has often appeared to me that this great change in the bird life is largely accountable for the spreading of the blackberry in the way in which it now occurs.

At the time of their destruction the plants in question had grown into very large bushes, so solid that they could be walked over. The method of destroying them was by sprinkling them (using an ordinary water-can) with either Merton's or Merton and White's sheep-dip, mixed a little stronger than for sheep-dipping purposes, and giving the plants a thorough soaking. Both these dips were of Hawke's Bay make, and, I understand, have arsenic as their bases. When dry the bushes were burnt, and afterwards the places where they had grown were thoroughly well saturated with the solution of sheep-dip, mixed as above described. None of these blackberries ever again showed above ground. In treating them in this way the important point appears to be the thorough saturation of the ground after the plants have been burnt off. Their destruction in this manner should, therefore, never be undertaken in the winter, but always in the summer, and when the ground is dry and warm.

The above will bear out the statement of Mr. Allen Williams, of Hawke's Bay, as published in the December *Journal*, that this method of destroying blackberry is absolutely certain. There are, however, several points to be considered in respect to it, such as the cost of transit of the material; the accessibility of the blackberry-bushes and their distance from water; the means at hand for transporting the water to where the plants are growing; the method of spraying, &c. Under one set of circumstances treating them in the manner described may be found to pay well enough, while under other circumstances the cost may be found to be prohibitive. As the whole question resolves itself into one of £ s. d., the result of careful experiments on this head naturally becomes of some importance, and will, I feel sure, be looked forward to with some interest by those who have blackberry land to bring into profitable occupation.

With reference to Mr. Tiffen's last remarks it may be mentioned that the Department has in hand arrangements for systematically testing the matter of blackberry-destruction by up-to-date spraying methods.

SPRAYING ON LIGHT LAND.

The Rev. A. O. Williams, of Wanganui, who has successfully destroyed blackberry on light land by the spraying method, was asked to give some particulars of his experience, and writes as follows:—

The blackberries poisoned by me were growing on sandy soil at Putiki, and consisted of a hedge which through neglect had spread to a width of a chain or more on the average. I used Makino weed-destroyer, and also a weed-poison prepared by Mr. White, of Otane, Hawke's Bay. The latter I found the cheaper preparation and very effective. It took two seasons to completely eradicate the pest, though the first season gave it a great sickening. I cannot say how many sprayings were necessary, but I used to spray as soon as young shoots showed themselves, and by doing so was able to run my cows in the

same paddocks after the first spraying and subsequent burning of the weed. I did not sow any grass-seed, as the grass took possession as soon as the spraying ceased. By following the directions on the drum of poison and using the spray whenever shoots appear any one can certainly get rid of the blackberry in two seasons, and, I am inclined to think, in one season on heavier soils.

HONEY-PRODUCING HEDGE-PLANTS.

F. A. JACOBSEN, Apiary Instructor.

THE matter of honey-producing hedge-plants that would assist the bees during the lengthy period between fruit-bloom and the autumn was under discussion at the last meeting of the Wellington and Moutere Fruitgrowers' Association. The writer was asked to supply a list of the most suitable hedge-plants that would be of benefit in providing pollen and nectar. The following are recommended, with reservations as indicated in several cases :—

Common Privet.—A good hardy hedge-plant that blooms white from the middle of November onwards. The scent from this plant is so strong that some object to it close to dwellings.

Elder.—A hedge-plant, but not commonly used, as it is apt to spread and become more or less of a nuisance, and is difficult to eradicate. It has clusters of white flowers that later turn into berries, and are commonly used for winemaking. Blooms freely.

Escallonia pterocladon.—The best of this kind for hedge-planting. It makes quick growth and blooms freely. A valuable honey-plant, forming a useful and ornamental hedge.

Escallonia macrantha. — Blooms bright-red flowers. A valuable honey-plant, and forms a good hedge.

Escallonia rubra, Escallonia exoniesis, and *Escallonia montevidensis,* may also be mentioned. The last named has large spikes of white blooms, and is useful as an ornamental hedge-plant.

Black-wattle (Acacia decurrens). — A fast-growing tree, excellent for general shelter, but not suitable for hedge-planting. Valuable in supplying pollen for bees.

Berberis Darwinii.—Makes a good evergreen hedge for small gardens. Requires clipping twice annually.

Sallow Willow.—Forms a strong hedge and is very valuable to bees. Blooms about the time fruit-trees are in blossom.

Tagasaste.—This is commonly but incorrectly called "tree-lucerne." The plant is exceptionally fast-growing, but should not be grown within the reach of stock. Requires frequent cutting, but is very valuable to bees, and blooms in the late winter and early spring.

WORK FOR THE COMING MONTH.

THE ORCHARD.

J. A. CAMPBELL, Assistant Director, Horticulture Division.

THE fruit season is now well advanced, and the orchardist in general will have plenty of work on his hands in dealing with the different classes and varieties of fruits as they reach maturity.

This is an interesting period with the fruitgrower, in that he is now beginning to realize what he may expect for his year's labour. Not only has he a fairly good knowledge of what the market is likely to do for him, but also what he is likely to do for the market in respect to the quantity and quality of fruit he has to offer for sale, and to what extent the care and attention he has given his trees has affected the result. This last is a very important matter, and one worthy of very careful analysis at the present stage, with a view to avoiding as far as possible, in the future, all mistakes either of omission or commission that may have been made. Quality should be the first consideration ; the higher the percentage of good-quality fruit, of course, the better, and there is no time when this is more appreciated and the reverse more noticeable and regretted than when the fruit is being prepared for the market.

Although the essentials necessary in raising a good crop of high-quality fruit are mainly within the control of the individual, there are some factors which, of course, are not, such as hail, excessive rain, frost, &c. But even the damage by rainstorms and frost can to a great extent be guarded against by providing a thorough system of drainage in the first place, and by adopting frost-fighting methods in the second.

Apart, however, from excessive climatic conditions, successful orcharding mainly rests with the orchardist. To state in detail how an orchard should be kept is practically impossible, as conditions and circumstances differ in almost every case, and there are a thousand-and-one things that are liable to crop up that cannot be covered in any routine method of treatment, and which must be left to the intelligence of the grower. The manner in which such details are attended to, however, often marks the difference between the successful and the unsuccessful fruitgrower.

The proper attention to an orchard, apart from the details referred to, includes thorough drainage, cultivation, and adequate shelter. The soil should be kept as free and friable as possible, and well supplied with humus and plant-foods. The trees, which should be of a class and variety suited to the market, should be kept growing freely from the time of planting until a well-shaped substantial tree is formed, and then steadied down, compatibly with health, to a suitable fruit-bearing condition. Periodical checks, such as follow droughty conditions; overbearing while young; damage such as from implements when cultivating; barking by hares or rabbits, &c.; disease-attacks; damage to foliage from spraying or other causes, should be avoided at all costs. Pruning should be regularly carried out at least each winter, and the trees should be trained preferably with an open centre, providing for a free admission of air and light to all parts. The control of diseases which affect the tree and also the fruit crop, with the exception of codlin-moth, leaf-roller caterpillar, pear-slug, &c., should be confined as much as possible to the winter and early spring remedies. The work at these periods should be thoroughly well done, with the object of lessening as much as possible the necessity of having to resort to drastic summer remedies.

Summer spraying for fungus diseases with either of our popular fungicides — Bordeaux mixture and lime-sulphur — is more or less dangerous to both fruit and foliage, according to climatic conditions at the time of spraying and the strength at which it is found necessary to use the mixtures. This applies particularly to Bordeaux mixture, the disastrous russeting effect on the fruit likely to follow the use of this fungicide being only too well known to all fruitgrowers. Although summer spraying for fungus diseases cannot be altogether avoided, the necessity of using strong mixtures can to a large extent be overcome by carrying out the earlier sprayings thoroughly. In order to produce a good crop of high-quality fruit, not only have the trees to be kept in good heart and free of injurious pests, but the fruit itself in most cases requires to be thinned. Judicious thinning not only ensures a larger, more even, and a better-coloured crop, but also allows of spraying being carried out more effectively, resulting in a much lower percentage of blemish from such diseases as moth, black-spot, ripe-rot, &c.

THE MONTH'S SPRAYING.

Eating-insects and Fungus Diseases.

Although the season is progressing and the time when spraying might safely cease is drawing nigh, that time is not yet. Mistakes are made along these lines every year, mainly in respect to codlin-

moth spraying. Commercial growers often make the mistake of ceasing to spray too soon in respect to particular varieties, while most non-commercial growers fail in regard to the whole. Apples and pears should be sprayed up to within a week or at most a fortnight of picking, until all danger of moth-attack is over, and that in regard to many districts is not until well on into March. This precaution becomes, if anything, more necessary in districts where the leaf-roller caterpillar is prevalent.

The necessity for making a thorough application of arsenate of lead shortly before picking is to guard against the danger of late infection by the moth. Should infection take place at this stage it might be easily overlooked, and many fruits containing minute grubs or moth-eggs may be packed, with the result that the consignment, if it happens to be held a few days, is liable to open up badly and be condemned by any Fruit Inspector who may happen to inspect it. This is a danger that should be particularly avoided in respect to fruit for export. When spraying at the stage above mentioned it is advisable to combine arsenate of lead with a weak solution of Bordeaux mixture or lime-sulphur. This is recommended mainly to destroy the spores of the ripe-rot fungus. In fact, a fungicide for this purpose should be applied generally to all apple and pear trees early in the month of February. The strength of spray to use at this stage is—Arsenate of lead (paste) 1½ lb. to 2 lb., combined with 3-4-50 Bordeaux; or lime-sulphur at the rate of 1 part of lime-sulphur to 120 or 130 parts of water.

The strength at which lime-sulphur can be safely used varies in different districts. Therefore, when spraying it should be diluted to a strength considered safe to the district in which it is being used.

Red Mite.

Lime-sulphur, when used throughout the season, is sufficient to keep red mite well within bounds, but for special purposes, particularly for stone-fruits, whale-oil soap will be found more effective. To prepare whale-oil soap:—

Warm 14 lb. of whale-oil, and in another vessel dissolve 2 lb. of caustic soda. Let this cool until it is just warm and then slowly add the warm oil, stirring well. When cold the mixture will set as a hard soap. Boil for about half an hour 5 lb. of this soap, 7 oz. of sulphur, and 5 oz. of caustic soda in 3 gallons of water. Make up to 40 gallons. Spray in the evening or on a dull day.

Woolly Aphis.

This prolific insect can be kept in check by combining "Black Leaf 40" with arsenate of lead when spraying for moth, but as a

special spray resin solution will be found to give good results. Resin solution is apt to scorch foliage if used early in the season. A slight amount of scorching is likely to take place at any time, but not sufficiently to be of any serious consequence when used from February onward. Resin solution is prepared as follows :—

Proportions : 5 lb. washing-soda, 5 lb. resin, and 40 gallons water.

Preparation : Boil 2 gallons of water in a vessel of more than twice that capacity. In this dissolve 5 lb. of soda, then add 5 lb. of resin, and boil until the resin is dissolved, stirring well. As the mixture very readily foams over, it is necessary to have some cold water at hand to add from time to time to prevent this. Continue to boil until all foaming ceases. Make up to 40 gallons.

SUMMER PRUNING.

Summer pruning when carried out in detail has a beneficial effect on fruit-production, but, generally speaking, it is doubtful whether the advantage gained is sufficient to warrant the time and trouble necessary in carrying it out, particularly as the work has to be done during the season when the fruitgrower has otherwise more work on his hands than he can well attend to. At the same time, although fruit-trees in most of the fruitgrowing districts of New Zealand bear readily enough when the winter pruning combined with a certain amount of summer work is properly attended to, there are special circumstances under which summer pruning may be applied with advantage.

Apricots, where inclined to be shy, can be greatly improved in this way. In this case the work should be commenced as early as the end of October or November, when the newly formed laterals are cut back to four or five buds. The tree is gone over again once or twice during the summer, when all renewals of growth are again stopped. Much the same treatment is often carried out with apples and pears ; all laterals when they have made 5 in. or 6 in. of growth are stopped by nipping out the soft terminal point. If this stopping is persisted in throughout the season the growths will invariably produce fruit-buds, but the work requires too much attention to be of any practical use to the busy orchardist, and in any case the majority of the laterals so treated would bear fruit almost as readily if left entirely alone.

The greatest advantage to be gained with the least amount of labour from the summer pruning of trees is in opening up a vigorous growing tree to admit air and light and at the same time checking its growth, thereby bringing it into a state more suitable for fruit-production. This work is usually done in the month of February. Opening up a young tree in this manner is not only beneficial in

the training of a tree and in bringing about the state required for early fruit-bearing, but with the apple it is very desirable in the control of woolly aphis. Woolly aphis finds ideal conditions when shaded from the heat of the sun and provided with the soft succulent growths to feed upon, such as abound in a dense and vigorous young apple-tree.

CULTIVATION.

The quantity of rain that has fallen in most districts this season precludes any danger of the fruit crop in general suffering from drought. At the same time, evaporation goes on rapidly during the heat of the summer, and cultivation should therefore be strictly attended to. Not only is this advisable from the point of view of preserving the soil-moisture, but also to destroy all rapidly germinating weeds before they become too strongly rooted in the soil.

POULTRY-KEEPING.

F. C. BROWN, Chief Poultry Instructor.

CARE OF YOUNG STOCK.

THE work of incubation is over until another season, and the bulk of the chickens should have reached a safe age, but there are many important matters to attend to at the present time. The increasing cost of foodstuffs makes it imperative that no detail be neglected which affects the cost of production. There must be no delay in clearing out every inferior hen, as well as all surplus cockerels that have attained a marketable age. This will make room for the growing pullets, so that they may be placed under the very best conditions possible. It should be unnecessary to emphasize that it is from the pullet that the largest profits of the year are to be derived. This is not to say that all pullets will lay during the dear-egg season. Usually the pullets hatched in the early season, about July, will commence to lay about New Year and go into moult before winter sets in. The pullets that must be depended upon to produce the winter eggs are those that have been brought out at the right time—say, in September for the light breeds and August for the heavy breeds.

Even pullets hatched out at the right time will fail to produce their maximum egg-yield if the management is not correct in every detail. In order to encourage healthy and vigorous development it is essential that the growing birds be given as free a range

as possible, and a plentiful supply of plain, nourishing food. There is no better food for young stock than good plump oats. If there is any difficulty in getting the birds to eat the oats when given whole, they may be ground and mixed with the morning mash. Overforcing with meat or its substitutes must be carefully guarded against, for it can be easily oversupplied. Not only will a too-liberal ration of meat food tend to bring on the common trouble of leg-weakness, but it also has the effect of unduly forcing the egg-producing organs, thus bringing the birds to lay before they have attained the desired size, and thereby making them short-seasoned layers of small eggs. Growing pullets can be overforced, retarded in production, or brought to lay just when required by the methods of feeding employed. Green food should be supplied in abundance. It is surprising the amount growing chickens will eat—to their own advantage and also that of the owner's pocket, as a liberal ration of green food will cause the birds to eat less of more expensive foodstuffs.

CLEANING THE QUARTERS.

It may be well to again emphasize the great importance of thoroughly cleaning the quarters where adult stock have been accommodated and the young pullets are to take their place. There are few houses where old birds have been kept which are quite free from vermin, and it is only placing the pullets at a great disadvantage by introducing them to lice-infested quarters. It should not be thought that because vermin cannot be seen in the house that they are not present. The most dangerous of parasitic pests which affect poultry torture the birds by sucking the blood at night, harbouring by day in the cracks and crevices of the houses. There is no better means of thoroughly clearing out vermin and destroying the germs of disease which may lurk in cracks and crevices than by giving the whole of the interior of the houses, including the perches, dropping-boards, nests, &c., a good coating of tar, and when thoroughly dry following it by spraying with lime-wash. This will have the effect of closing up all the hiding-places of the vermin, so that when the spraying with a disinfectant takes place this may be thoroughly effective. Spraying with disinfectants is often condemned as not being sufficiently strong to effectively destroy vermin. In most cases the disinfectants are strong enough, but the trouble is that the spraying-material does not reach many of the crevices and cracks where the insects swarm most thickly.

Some poultrymen imagine that by giving a house a rest for a few weeks the vermin will be starved out. This is a great

mistake. I have seen a house badly infested with red mite which had not had a fowl in it for many months, and this was during the winter season in Otago. It should be remembered that lice are a constant drain on a fowl's vitality, and where these pests are numerous a bird cannot make the best use of the food it consumes. It is comparatively easy by observing proper cleanliness and avoiding overcrowding to prevent the red mite from ever making an appearance in the poultry-house. Only those who have had experience in combating this pest can realize how very much better it is to prevent than to wait until it becomes necessary to cure.

REARING DUCKLINGS.

The writer has received several reports of heavy losses of young ducklings in the brooder stage, when from five to ten days old. In most cases the symptoms described are that the birds just previous to dying stagger and fall on their backs, with their eyes twitching and in a generally distressed condition. The trouble is a common one, and may be due to several causes, especially during the hot weather. Failure to provide proper shade, thus allowing the ducklings to become affected with sunstroke, is sometimes responsible. Another cause is giving the young birds water first thing in the morning before feeding, with the result that they gorge themselves. *It is advisable to give food in the morning* previous to a drink being supplied.

The chief cause of the trouble, however, is too high a temperature, together with insufficient fresh air, in the brooder-box. Generally speaking, ducklings require much the same treatment as chickens in the artificial process of rearing. It should be borne in mind, however, that they are naturally more hardy than chickens and must not be coddled. The heat in the brooders must be reduced much sooner, and abundant fresh air provided. It cannot be *emphasized too strongly that the keynote of successful rearing* of ducklings is ample ventilation in the brooders. Even when they are first placed in the brooder it should be so arranged that the desired heat can be secured without excluding fresh air. Good food and cleanliness are certainly essentials in rearing ducklings, but even these count for little if the birds are placed in a brooder that is insufficiently ventilated. During the summer season artificial heat, if reduced by degrees, can usually be dispensed with altogether when they are about three weeks old. Of course, climatic conditions must at all times be taken into consideration. In favourable weather the ducklings may be let out of the brooder and given a limited run both by day and night on the third day after removal from the incubator. The fireless brooder, as

illustrated in last September's issue of the *Journal*, is strongly recommended for rearing ducklings.

Food is not required for at least thirty-six hours after hatching. The first meal may consist of equal parts of scalded bran and pollard mixed with a small quantity of oatmeal, to which a handful of fine grit should be added. The grit assists in the proper digestion of the food. Feed this mixture four times a day, giving all that the birds will clean up. When they are a week old the grit need not be mixed with the food, but may be kept in a shallow dish, so that they can eat as much as they require. As they grow older grit of coarser size should be supplied. From a fortnight old feed three times a day with equal parts of pollard, bran, and maizemeal, and continue giving this ration until they are ready to kill. As already mentioned, ducklings should on no account be given water to drink in the morning until they have *been fed, as they are liable to drink to excess, with injurious* results. When the birds are a few days old finely-cut green food, such as lettuce, young tender grass, &c., should be fed daily. If soup or skim-milk is available, it may be used with advantage for mixing up the mash.

On account of the thinness of their skulls, ducklings are very subject to sunstroke and giddiness, and therefore shade should always be provided. When very young they should not be allowed water to swim in. The drinking-vessels should be deep enough to enable them to clean out their nostrils and so prevent the latter from getting clogged up, as this is a frequent cause of trouble. Some fine gravel placed in the drinking-vessel will greatly assist in moving any food or dirt from their nostrils.

As a matter of fact, ducklings are much more easily reared than chickens, either artificially or with the natural mother, and provided they are given reasonable attention the death-rate should be practically nil.

SEX-CONTROL.

A correspondent who obtained some few weeks ago several sittings of eggs from one of the Department's poultry-stations reports that the hatching-qualities of the eggs were all that could be desired. He considers it strange, however, that the great majority of the birds hatched out have proved to be cockerels, and is sure that the high percentage of males is not a good advertisement for poultry-station eggs. The correspondent is evidently labouring under the delusion that eggs can be selected at will which will produce males or females as the case may be. There are many theories put forward as to how the sex can be determined, such as by the shape of the egg, the position of the air-

cell, &c., but none have been proved to be of any value when put to a practical test. A short time ago it was thought by many that the so-called sexaphone had solved the problem. This instrument consisted of a small piece of steel suspended by a piece of steel wire. The inventor claimed that its varied movements when held over an egg would indicate the sex accordingly, or whether it was fertile or not. This, like many other devices or theories, had a short life, and hopelessly failed when put to a thorough test. In many cases coincidences whereby a predominance of pullets have been obtained, or *vice versa*, have strengthened the belief in these alleged systems of determining the sex of eggs, but beyond this they are not worth referring to further. No doubt the poultryman would welcome any system which would enable him to secure the desired number of pullets. It would, however, appear that this is one of nature's secrets that will not be divulged.

THE APIARY.

E. A. EARP, Apiary Instructor.

EXTRACTING.

EXTRACTING should now be in full swing in all districts in the Dominion. Where operations for any reason have been delayed care must be taken to see that the bees are not crowded out, or they will commence to loaf, and the ultimate crop will be small. It is a good policy to extract twice during the season, but where the beekeeper prefers to leave the work until the end of the flow a close watch should be kept so as to provide ample room. This, however, can only be done where large numbers of spare combs are kept on hand. It is during the season when honey is coming in freely that the beekeeper realizes that his most valuable asset next to his bees is a good stock of extracting-combs. Every effort should be made to get at least twenty spare combs for each hive in the apiary, and with this number always on hand the bees are not likely to be hampered for room. In the absence of plenty of drawn-out combs the best plan is to keep the extractor going, and thus prevent the bees from blocking the brood-combs. This usually happens unless ample room is provided, and as a result the queens are prevented from laying to their utmost, and the colonies dwindle. At no time during the working season should the work of the queen be hindered. Care must be taken at all times to see to this im-

portant item during the flow. The honey is quite ready to extract when the combs are a half to three-parts capped, but great care must be exercised not to extract unripe honey. Some experienced beekeepers do certainly resort to extracting unripe honey, but its after-treatment requires great skill, and should not be attempted by the amateur or novice under any circumstances. Numerous instances have come under my notice where the practice of taking unripe honey has meant a total loss to the beekeeper.

REMOVING HONEY FROM THE HIVE.

The usual practice followed when the time for extracting is at hand is to remove the frames one by one. If excluders are used much time will be saved in picking over the combs. As the combs are taken from the hive shake the bees in front of the hive, brush off the remaining bees, and place the combs in a super for removal to the honey-house. The combs should be covered with a cloth which has been previously placed in water containing a small percentage of carbolic acid. When the season is at its height very little trouble will be experienced from robbers, but in case of a stoppage in the flow the above precaution is necessary. At all times the beekeeper should study his working-equipment, and this is highly important when removing the honey. It will be found convenient to provide a good barrow or truck for carrying at least two full supers. Much time and labour will be saved, and the tedious work of removing the honey will be facilitated.

UNCAPPING.

One of the most important processes in the work of extracting is that of uncapping. There are several kinds of knives for the purpose on the market, but the stiff-bladed double-edged Bingham is usually first favourite. Two of these are necessary, and they must be stood in a pan of water which is kept boiling on a small lamp. Each knife as it becomes cold is returned to the boiling water and the hot one takes its place. Any contrivance which is used for an uncapping-can should be provided with a cross-bar, through which to pass a screw or similar article, driven point upwards, to form a pivot on which to rest and revolve the combs. The comb should be placed with one end resting on the pivot and tilted slightly forward, in order to allow the cappings to fall away from the comb. Uncapping should commence at the bottom of the comb and proceed with a sawing motion from side to side until the top of the comb is reached. The comb is then swung round on the pivot and the reverse side treated in

the same manner. Only a thin sheet of wax should be removed, but it must be done thoroughly so that every cell is opened, and at the same time the top and bottom bars should be relieved of any burr-combs which may adhere to them. A contrivance much in favour with progressive beekeepers is the steam-heated knife. This is a Bingham knife with a soldered copper plate, so arranged that steam is forced through it from a rubber tube attached to the spout of a "bronchitis" kettle. An escape-tube is fitted to the opposite side, and the knife is kept at a very high temperature all the time uncapping is proceeding, thereby obviating the work and trouble of continually plunging the knives into boiling water. For uncapping heavy fully capped frames it has no equal, as an ordinary uncapping-knife becomes cold as a rule before half one side of a full comb has been uncapped. The cappings should be left to drain for two or three days, after which time they should be gathered and melted, preferably in a solar wax-extractor. By this means the finest and purest wax of the season will be obtained.

STRAINERS.

It is not uncommon to find honey exposed for sale where proper care and attention has not been paid to straining at the time of extracting. Nothing deters the sale of extracted honey so much as a layer of wax-particles, dead bees, &c., and it is surprising how few beekeepers take the necessary trouble to see their product reaches the customer free from wax and other impurities. In no case should honey be run direct from the extractor into the containers, but should be properly strained. It is the attention paid to this necessary detail that aids in the sale of the crop, and when honey is properly treated it readily commands a higher price. Fine wire-gauge strainers are usually adopted, but even these are not sufficient to remove the smaller wax-particles. In order to ensure perfect condition it should be passed through good fine cheesecloth before being run into the tank. Cheesecloth strainers are excellent, cheap, and are easily made, whilst at the same time they can be readily cleansed. They remove everything but the smallest particles *of wax, which should be finally disposed of* when the honey is skimmed. This latter process is an important one, and should always be carried out before the honey is put up in marketable form.

SOLAR WAX-EXTRACTOR.

Every beekeeper with a dozen or more hives should provide himself with a solar wax-extractor. During the working season

there is usually an accumulation of burr-comb, drone-comb, and other pieces of wax, which often are allowed to waste through the attention of the beekeeper being occupied in securing a crop. As a rule there is a large annual wastage of wax, and too little attention is paid to stopping the leakage. The reason that solar extractors are not in general use may probably be because they have been roundly condemned by beekeepers who have not given them a proper trial. Under ordinary circumstances, if properly constructed, solar extractors will deal with the accumulation of wax and reduce the combs into marketable form. In the absence of a steam capping-melter the cappings may be reduced and the honey and wax separated at the time of extracting by bringing into use the solar extractor. These extractors soon pay for their cost, and no apiary equipment is complete without one. The price of wax and its scarcity should induce the beekeeper to save every particle. Small extractors may be purchased from the hive-dealers, but where expense has to be considered the bee-keeper may find it profitable to make one himself. Dimensions, &c., for a home-made extractor were given in a note on wax-extracting by Mr. F. A. Jacobsen in the December, 1912, issue of the *Journal*, page 647.

SUPERSEDING QUEENS.

As advised in a previous note, all old and failing queens should be superseded. It is a good plan to utilize surplus queens carried over in the nucleus hives to do the work. When due attention is given to requeening the apiary there is less likelihood of queenless hives in the spring. Remove all old queens in the apiary, and especially guard against wintering colonies except those headed by a vigorous mother.

APIARY REGISTER.

There is no gainsaying the advantages to be derived from making a complete record of the individual hives in the apiary. Records thus kept enable the beekeeper to work to a system and tend to improve apiary-management. It is wellnigh impossible to conduct an apiary on commercial lines unless the beekeeper takes notes at each examination. Working in the dark, with respect to the age of queens, surplus, &c., is poor policy. In the absence of books the hive-cover may be used for writing notes on. A book may be mislaid, but records made inside the cover are more in the nature of a permanent handy reference. If advisable, these rough notes may be copied in the beekeeper's spare time into a complete record-book.

TREATMENT OF DISEASE.

No effort should be spared to treat all colonies known to be affected with disease. If the work is delayed the colonies will not build up to sufficient strength to winter safely. Under no circumstances should the work be put off. Treat all infected stocks while the flow is on, and endeavour to winter none but clean colonies. There is a great risk of spreading the disease to clean colonies in the off season, as robbing is more apt to break out. "Keep your bees clean" should be the maxim of every beekeeper. Where any doubt exists as to the complete absence of disease in the apiary an excellent plan is to mark all combs with the number of the hives to which they belong, so that when extracted they may be returned to the colony from which they were taken. If this plan is followed, even if any of the hives are diseased, the risk of spreading infection by means of wet combs is considerably reduced.

THE GARDEN.

W. H. TAYLOR, Manager, Arataki Horticultural Station.

VEGETABLE-CULTURE.

In most places the month of January is the most profitable time to plant cabbages, broccoli, and kale for winter use. In the hotter districts—Hawke's Bay, for instance—it is better to delay planting for perhaps a couple of months. The weather in these parts is usually so very dry and hot at the time mentioned that plants can only be established with difficulty. There is also the diamond-backed moth to be reckoned with, or, rather, its caterpillar. Planted at the later date the heads may not be of the largest, but there is more chance of success. It would not be too late to sow seed now for these late plantings. Sow thinly, and bring the plants on rapidly by attending to watering. The soil for broccoli in particular should be firm; they seldom do well in loose soil. The plants should not be grown too soft; if they are watered much or treated to forcing-manures while in the seed-bed the plants are likely to suffer when planted out. The thing to aim at is tough, hardy plants, such as are grown on soil of only moderate richness. Such plants are best able to bear the check of transplanting under hot sunshine. The plants should, however, be well filled with water before they are planted, and this is best

accomplished by standing the roots in water for an hour or so after lifting them. When only a few are planted it is easy to keep them watered, but this is not so with large numbers. It is then that the benefit of the plan above mentioned is felt; the plants being filled with water can afford to lose some of it by evaporation and still retain sufficient to give them a fresh start.

Brussels sprouts should be out by now; they will not give good returns unless they have time to grow to large plants. Sow peas and French beans for succession. Peas should be of the second early type, and none should be sown in hot districts. Silver-beet makes a good standby in case cabbages fail; it may be sown now. As the soil will most likely be dry, the drills should be well watered after the seed is in, and before covering it up. By doing this the seed is moistened as well as the soil; the dry covering acts as a mulch, and keeps it moist long enough to germinate the seed. The same plan is effective with spinach, which may be sown at once for winter use in the colder parts; a month hence in the warm places. Peas may also be treated in the same way, and it will be found to be far more beneficial than soaking the seed and then sowing in dry soil, which absorbs the moisture from the peas or other seed so treated. Lettuce should be sown in rows, and the plants thinned out in preference to transplanting. Sow turnips still in small lots.

Marrows, pumpkins, cucumbers, and the several varieties of melons will now be in a fruiting state. Strong runners should be stopped to cause the production of side shoots, which are the fruit-bearers. Thinning fruit is necessary to secure good samples. This is advisable in most cases, the extent of the thinning depending on whether the object of the grower is to limit the fruit to one or two large specimens to a plant. This remark applies to pumpkins of the giant kinds.

Tomatoes should at this time require no other attention than nipping out side shoots as soon as possible after they show. Keep the soil about them loose by hoeing, at the same time destroying seedling weeds. The same advice applies to the whole of the garden. Good cultivation is better than watering; besides which, watering is more often than not impossible excepting to a small extent, and this often does more harm than good.

THE FLOWER-GARDEN.

Violets are commonly attacked by red spider about this time. The best remedy is to cut off the leaves. The leaves may be mown off with a scythe; collect and burn them. This may appear

a drastic remedy, but it does the plants no harm to take off foliage, which will die in any case, as no amount of spraying will save the affected leaves, even if it killed the mites; for the foliage invariably dies after an attack by red mite, or "red spider," as it is usually called.

Carnations can be propagated in several ways, and by the various methods propagation may be carried on throughout almost the entire year. Two ways are most appropriate for this season—that is, by layers, and by pipings in a close case in a greenhouse. When soft-wooded plants are to be rooted from cuttings—in the case of carnations, called "pipings"—it is essential to prevent wilting. A certain amount of top growth is necessary before roots are emitted. At this time of the year, when outside conditions are hot and dry, it is difficult to prevent wilting outside. A close case in a greenhouse is easily kept moist, and so prevents wilting. A small frame will answer very well if the light closes perfectly. The pipings are to be made of healthy shoots of medium thickness, firm, and not too gross. Make the pipings about 3 in. long, cut just below a joint, and cut off the leaves from the portion that will be buried in the soil. Prepare boxes of light soil with at least $\frac{1}{2}$ in. of sand on the surface. A layer of sphagnum moss is good on the bottom of the box. After putting in the pipings water them well; after they are in the frame give as little water as possible consistent with keeping the soil moist until they are rooted. The success of the operation is more dependent on preventing wilting, as aforesaid, than on warmth provided in a greenhouse, so that they may be rooted outside if a suitable position can be found, and later on the difficulty is lessened, as conditions are less hot and dry.

When one has a stock of plants in the garden to work from the best mode of increase is by layering, which provides stronger and better-rooted plants than pipings. The way to layer is to remove a number of the lower leaves, make a tongue on the lower side by cutting half through with a sharp knife, and carrying the knife about $\frac{3}{4}$ in. up through the centre. The tongued layer is then to be pegged securely into the soil in such a way as will ensure the tongue being kept open, and covered with light soil; a little sand may be advisable. The layers usually root in four or five weeks. The operation of layering should not be delayed.

Sweet peas that are flowering should not be allowed to ripen seeds, or they will soon cease to grow. In dry places watering will be necessary during hot weather, and a good mulch is advisable. Annuals of all kinds should be relieved of seed-pods. The plants stop growing if allowed to ripen seeds. Annual phlox is

quickly exhausted in this way, yet it will flower for a long time if stripped of seed-heads.

Belladonna lilies, clivias, and brunsvigias are mostly below ground at this time, though only for a very short period, and the time varies with the conditions in various parts. These bulbs may be transplanted before they start again, which will be very soon. The bulbs should be planted very deep. A hole nearly 18 in. deep is necessary except in places more than ordinarily moist.

All bulbs that are now dormant may be taken up if desired, but in the case of narcissi it should not be done except for good reasons; they are best left now, as most of them have new roots, though not top growth. If they are taken up they should be replanted at once. Hyacinths and tulips may be lifted. It is not in all cases necessary to lift either every year; both keep quite well in the ground, provided the soil be free and well trenched and drainage good.

Quite early in the month the zephyr - flower, *Zephyranthos atamasca*—now called *Amaryllis atamasco*—may be planted. This is a beautiful little bulbous plant with pure-white flowers, valuable for floral work, and also very attractive in the garden. The bulbs increase with great rapidity. Autumn crocus—Colchicum—and the yellow-flowered crocus-like *Sternborgia lutea* may be planted, both being very acceptable plants. A close watch should be kept over the choicer bulbs, such as Lycoris, Norine, &c. These suffer if the ground cracks, and are likely to be lost if smothered with weeds, or when labels are lost. All danger is averted by covering the soil surrounding the clumps with a few inches of sand, which serves to mark the site of the bulbs and prevents cracking of the soil. Japanese Iris, being water-lovers, need some protection from the sun in hot places; a good mulch will prevent the soil drying out to a large extent. The plants like plenty of sun if the soil is moist; the place they thrive in best is alongside a stream, where the roots can reach the water and the tops be fully exposed to the sun. They do well, however, in good, well-trenched soil, but will not bear starvation.

A settler at Arahura, Westland, who has been in the habit of carting wood-ashes from the dump of a sawmill and putting them freely into his land, obtains fine crops of potatoes and turnips—sometimes when those of neighbouring farmers are indifferent or even a failure. The fertilizing and soil-improving properties of wood-ashes (with their large lime-content—apart from the potash) should be more generally realized.

ANSWERS TO CORRESPONDENTS.

IN every instance a question to which an answer is desired in the *Journal* must be accompanied by the full name and the postal address of the inquirer, not necessarily for publication, but as a guarantee of good faith. The question should be written on one side of the paper only.

BRUSHING IN HORSE.

"ANXIOUS," Hopelands :—

I have a young mare (three years old) which has just been broken in. She brushes badly on the off hind fetlock. Is there any known cure or preventive of this ?

The Live-stock Division :—

Brushing is a common complaint in young horses, especially when in a low condition. Alteration in gait whilst being broken in is another factor. Boots or pads should be used until these conditions are overcome. In older horses, when brushing is due to a malformation, an alteration in shoeing usually overcomes the defect. Thickening the outside heels of the shoes may be tried, and if not successful try thickening the inside heel. A calkin should not be used.

MANURING TOMATOES.

A. T., Frimley :—

Please let me know the best kind of manures for filling out tomatoes in a glass-house, and the right proportions to use as a liquid manure.

The Horticulture Division :—

The tomato is a plant that is naturally very vigorous in growth. The wise cultivator endeavours to check grossness of growth, as it tends to long-jointed plants, and also provokes attack of disease. If the plants are vigorous, or have been given manure previously, it is likely that applying more would do harm. The best plan would most likely be to ease off on the water-supply somewhat. The plants do not require much feeding to enable them to swell the fruit. On the other hand, if growth has not been good some feeding would not do harm. The best liquid manure is made from cowdung ; it is mild in action, and does not excite the plants in the manner that artificial fertilizers are apt to do. The liquid may be given a little darker than ale. Apply after watering with clean water, not while the soil is dry. Give it not more than once a week. Blood manure is also good ; apply 1 oz. per gallon of water.

PRESERVING GREEN PEAS.

L. J. A., Waihemo :—

Kindly inform me whether green peas can be bottled in water in the same way as gooseberries. If not, what is the best method ?

The Horticulture Division :—

The following is a reliable method for preserving green peas : The peas must be young—*i.e.*, not starting to make growth. Scald and partly cook the peas in a

sieve, wire basket, or colander. Wash thoroughly in cold water, two or three changes. Fill the bottles, and complete the filling with very light brine (just to taste the salt only). Preserve as fruit, but count the time from when the water reaches 180° F.: bring up to 200° to 205° F. and preserve for fifteen minutes or longer if the peas will stand the process, which they should do if correct in variety and condition. Twenty-five minutes and upwards is preferable. Screw down and allow to cool as usual.

POULTRY-FEED.

A. N. W., Hikurangi :—

Will you kindly inform me whether linseed and sucrosine as sold for calf-food have any value as poultry-feed, and whether either would be suitable to mix with mash, and, if so, in what proportions to bran and pollard. I experience a difficulty away North here in securing any article to supplement the bran and pollard in mash. Can you recommend anything else if above is not suitable?

The Live-stock Division :—

Linseed is very rich in oil, and a small quantity mixed in the mash is beneficial to poultry during the moulting-period. Sucrosine is suitable for inclusion in the mash. Being a fattening-food, it can be used more liberally for birds that are being prepared for table purposes than with the laying flock. The use of lucerne, either chaffed and steamed overnight and mixed in the mash or in the form of meal, is strongly recommended as the best means of effecting economy in feeding. Maize-meal and crushed oats (sparrowbills) provide a valuable addition to bran and pollard, making the mash crumbly and palatable. Peameal and barley-meal are also useful foods, the former being more suitable for using in cold weather. A variety of foods is recommended throughout the year, but the proportions require to be also varied according to the weather conditions.

SWELLING ON HORSE'S LEG.

"NEW CHUM," Owaka :—

Would you please tell me the best thing to take down a swelling on a horse's leg just above the knee, caused by a knock. It is soft yet, but has been there some time. It does not affect his going, but seems to be up the sinew in front of the leg. Iodine does not seem to take it away. He is a hunter, and is only worked two or three times a week.

The Live-stock Division :—

The treatment in the first stages would have been to apply cold water for five minutes three times a day and rub dry. We should now advise rubbing in crude castor-oil for fifteen minutes, and repeating the application in three weeks' time if necessary.

LOSS OF HAIR IN COW.

"SUBSCRIBER," Waitahu :—

I have a cow that is affected with some sort of skin-disease. Practically the whole of her hair has come off, leaving her skin quite smooth, but the hot sun is now causing her skin to crack. The hair started to come off from around her eyes and head first and gradually worked back. It does not seem to resemble ringworm. I have already washed her in a strong mixture of non-poisonous dip and am waiting results. The cow (a heavy Shorthorn) is in prime condition, and seems healthy otherwise. Kindly let me know if the disease is contagious, and if it can be cured; also what treatment and any other particulars you think necessary.

The Live-stock Division :—

This complaint is non-contagious, and is probably due to some dietetic trouble. Treatment consists in giving the cow an aperient drench—Epsom salts ¾ lb. to

¾ lb. and powdered ginger a dessert-spoonful mixed in a quart of gruel. As a general rule, no outward applications are required, except in cases such as you mention, when the sun affects the bare skin. A little boracic or zinc ointment lightly applied should then be used, and the animal kept in the shade as much as possible.

KUMARA-GROWING.

S. A., Coromandel :—

Kindly inform me how best to plant and grow kumaras—*i.e.*, how far apart, *in rows or hills, with or without manure; and how to keep them in good condition* after they are dug up. I grew some last year which went all slack and withered in about a fortnight or less. Also please state the best way to keep the tubers for seed until next planting.

The Horticulture Division :—

Kumaras do best in a sandy soil or one not too heavily charged with vegetable matter. If stable manure is used it is better applied to some previous crop. Cultivate the land well and ridge up about 30 in. apart. Ridges should be from 4 in. to 6 in. high. Plant from 18 in. to 24 in. apart, making a small hollow around each plant for moisture purposes. Lime has a beneficial effect on a kumara crop, so also have artificial manures. The following mixture of fertilizers is recommended: Sulphate of ammonia, 100 lb.; blood and bone, 200 lb.; superphosphate, 500 lb.; sulphate of potash, 200 lb. Apply and work in well about a week or ten days before planting, at the rate of 5 cwt. and upward per acre.

The old Maori method of keeping kumaras in pits gives the best results. A pit of sufficient capacity is made in the ground in as dry a situation as possible. When ready, the pit is roofed or thatched to keep out the weather. The tubers should be thoroughly dried before storing, and prevented from coming in contact with the floor and sides of the pit by using layers of dry fern or straw. The pit should be opened every fine day until the sweating-period is past; this lasts about a month. Even afterwards an occasional ventilation is advantageous. Kumaras for propagation can be kept in the same manner.

TAPE-WORMS IN DOG.

F. MAYMAN, Albany :—

Please tell me how to rid a nine-months-old dog of tapeworms. I have been using areca-nut. This clears the worms out only temporarily; they grow again. Perhaps there is a special way of applying the dose.

The Live-stock Division :—

The following treatment will be found beneficial: Powdered areca-nut (fresh ground) should be mixed as a bolus with male fern, and for a sheep-dog a pill about the size of the circumference of a threepenny-piece can be given in the morning, fasting. A five-grain rhubarb pill or a dose of castor-oil can be given the following morning. The dose may be repeated in ten days' time. Care should be taken that all organs such as sheep's livers, lungs, &c., are boiled before given to dogs, as the hydatids frequently found in such organs produce the tapeworm in dogs.

GARDEN MANURING AND TRENCHING.

"NOVICE," Methven :—

1. What method would you suggest to kill weed-seeds in stable manure before digging it into garden?

2. What is your opinion of sheep-droppings for garden-manure?

3. Would trenching benefit a garden where there is only about 10 in. of top soil? The subsoil is clay similar to that all over the Canterbury Plains.

The Horticulture Division :—

1. The heat generated by the manure itself is sufficient to kill the weed-seeds in it, provided it is well stacked, trodden down, and covered with a layer of soil, and left for three or more months. Should the manure before stacking be on the dry side or the amount of straw in it be large, every layer put on, say, 1 ft. thickness, should receive a good watering.

2. As a manure sheep-droppings are more valuable than stable manure—more concentrated. There is the same trouble with weed-seeds in this manure as in the other. To kill the seeds it should therefore be prepared in the same way as the stable manure, but this is very rarely done.

3. It may be broadly stated that all garden soils are benefited by trenching. In carrying out the work of trenching, it should be so done that the top soil is left on the top as much as possible, otherwise more time is required for the new surface to mellow down into good form for planting.

HAY FOR POULTRY LITTER.

"SUBSCRIBER," New Plymouth :—

Kindly tell me whether in keeping poultry on the intensive system hay would be suitable to put on the floor of the house as litter instead of straw. I am informed that hay is likely to form a ball in the crop, and is sometimes fatal to the fowls, who swallow pieces when feeding.

The Live-stock Division :—

There is no objection to using thoroughly dry hay which has been properly cured. If insufficiently dry grass is used for litter the birds will sometimes eat it, and thus cause the trouble you refer to. This seldom occurs, however, where they are provided with a regular supply of finely chaffed succulent green food. A hen knows better than to swallow pieces of litter accidentally. When she eats material of this sort it is to satisfy the demands of her system for green vegetable matter which is in insufficient supply.

FORTHCOMING AGRICULTURAL SHOWS.

Helensville A. and P. Association: At Helensville, 29th January.
Woodville A. and P. Association: At Woodville, 31st January.
Feilding A. and P. Association: At Feilding, 6th and 7th February.
Central A. and P. Association: At Waipukurau, 7th February.
Opotiki A. and P. Association: At Opotiki, 8th February.
Pahiatua-Akitio A. and P. Association: At Pahiatua, 9th February.
Dannevirke A. and P. Association: At Dannevirke, 14th, 15th, and 16th February.
Hukerenui Agricultural Association: At Towai, 15th February.
Te Puke A. and P. Association: At Te Puke, 15th February.
Northern Suburban A. and H. Assn.: At Takapuna, 16th and 17th February.
Northern Wairoa A. and P. Association: At Mititai, 17th February.
Masterton A. and P. Association: At Masterton, 20th and 21st February.
Franklin A. and P. Society: At Pukekohe, 23rd and 24th February.
Rangitikei A. and P. Association: At Taihape, 28th February.
Taranaki Agricultural Society: At New Plymouth, 28th February and 1st March.
Rotorua A. and P. Association: At Rotorua, 2nd March.
Hawke's Bay A. and P. Assn.: Autumn Show at Hastings, 6th and 7th March.
North Kaipara A. and P. Association: At Paparoa, 7th March.
Ashburton A. and P. Association: At Ashburton, 14th and 15th March.
Matamata A. and P. Association: At Matamata, 21st March.
Temuka and Geraldine A. and P. Association: At Temuka, 22nd March.
Methven A. and P. Association: At Methven, 29th March.
Mackenzie County A. and P. Association: At Fairlie, 9th April.
Oxford A. and P. Association: At Oxford, 5th April.

BOARD OF AGRICULTURE.

THE Board of Agriculture held lengthy meetings on the 10th and 11th instant, when several important matters affecting the agricultural interest were dealt with.

Wheat-growing.—The Board had a long conference with the Hon. W. D. S. MacDonald, Minister of Agriculture, and the Board of Trade, and discussed with them the best means to be taken to encourage farmers to put in an increased area of wheat. After carefully considering the question in committee, a number of recommendations bearing on the question were forwarded to the Minister.

Noxious Weeds.—A lengthy report dealing with the question of the control of noxious weeds was also fully discussed with the Secretary of the Department of Agriculture and his officers, and arrangements were made to collate and utilize the information that had been collected as to the best methods of dealing with the most troublesome weeds in different parts of the Dominion. Steps were also taken to formulate a number of proposed alterations in the Noxious Weeds Act, with a view of getting the Act amended during the coming session of Parliament.

Stubble-quail.—Reports were received from Mr. W. J. Spafford, Department of Agriculture, Adelaide, South Australia, and from the Acting Chief Inspector of Fisheries and Game, Victoria, with regard to the life habits of the stubble-quail. In both reports the opinion was expressed that Australian stubble-quail, if introduced into New Zealand, would not be likely to prove harmful to farmers; on the contrary, it was stated that these birds eat an enormous quantity of weed-seeds and insects, and mention was made of the fact that in southern Victoria their favourite food was the black seed of the spear-grass, dock-seeds, crickets, and weevils. It was urged by the Australian writers that it was one of the few introduced birds that was doing a very good work, and that should be protected all the year round because of its value to the agriculturist as a weed and insect destroyer. The Board decided to thank the writers for the information furnished, and to forward copies of the reports to the Minister, and to the New Zealand Farmers' Union for the information of the members of that body who had expressed fears that the introduction of stubble-quail into the Dominion might prove a menace to the farmer.

Limestone.—Valuable reports from certain officers of the Public Works Department with regard to the deposits of limestone in Taranaki, which had been sent on to the Board by Mr. Morgan, Under-Secretary of the Mines Department; also a report from Dr. Henderson, of the Geological Survey, on the subject of limestone for agricultural purposes in Westland and Nelson, were received and dealt with; and it was resolved to express to Mr. Morgan the thanks of the Board for the assistance he had rendered in this matter.

Potash.—A considerable amount of information had been collected with reference to the manufacture of potash in New Zealand for agricultural purposes, and the views of some of the experts of the Department of Agriculture were taken; but it was finally agreed to deal with the question again at the next meeting, when Mr. Aston, Chemist to the Department, and Mr. Brown, Director of the Fields Division, could be in attendance.

Ashburton Experimental Area.—Mr. Brown, Director of the Fields Division, gave the Board particulars of the experimental work that was being carried out by the officers of the Department of Agriculture in conjunction with the Ashburton High School authorities, and also informed the Board of the lines on which the Department proposed to work in its investigations to obtain improved cereals for the Dominion.

Miscellaneous.—Among other matters dealt with were the following:—

The work now being carried out at Te Kauwhata (Waerenga), Tauranga, and Arataki Horticultural Stations.

The suggested establishment of additional fruit experimental stations in the Dominion.

Improved methods of handling fruit on wharves.

Removal of the duty on timber imported from British possessions for fruit-box-making purposes.

Proposed legislation in regard to imported and locally grown seeds.

The question of a soil survey for New Zealand.

REQUISITION OF NEW ZEALAND WOOL.

THE following is the text of the schedule of the Proclamation, dated 21st December, 1916, requisitioning for war purposes all wool of the present season's clip in New Zealand, and giving effect to the arrangements made by the Hon. W. D. S. MacDonald, Minister of Agriculture:—

1. The persons, firms, and companies mentioned in the Appendix I hereto, and hereinafter referred to as Government wool-brokers, will act as the agents of the Government of New Zealand in respect of the aforesaid requisition of wool.

2. All owners of wool shall, as soon as practicable, deliver their wool at the wool-store of a Government wool-broker at one of the following ports—namely, Auckland, Tokomaru Bay, Gisborne, Napier, Wanganui, Wellington, Nelson, Blenheim, Christchurch, Timaru, Oamaru, Dunedin, and Invercargill.

3. All wool so delivered, and also all wool already in the wool-store of a Government wool-broker on the day of the making of this Proclamation, shall be examined, classified, and valued before shipment by two expert valuers, one of whom will be appointed by the Government, and the other of whom will be employed by the Government wool-broker in whose possession the wool is held.

4. If the two valuers are unable to agree as to the classification and valuation of any wool, it will be examined, classified, and valued by a supervising valuer to be appointed by the Government.

5. All such wool shall be classified and valued in accordance with the scale set forth in the Appendix II hereto, which shall be taken as representing the average prices of the various classes of wool as sold by auction in New Zealand in the month of January, 1914.

6. The Government will pay for all wool so valued a sum equal to the value so placed upon it, with the addition of 55 per cent. thereof.

7. Such payment will be made, free from exchange, on the fourteenth day after the date of valuation, to the wool-broker in whose possession the wool is held, and such wool-broker shall receive and account for the same as the agent and on behalf of the wool-owner.

8. On the receipt of such payment by the wool-broker he shall take possession on behalf of the Government of the wool so paid for, and such wool will thereupon become the property of His Majesty. Prior to such payment the wool shall remain the property of and at the risk of the wool-owner, but shall be kept insured against fire in its full insurable value by the wool-broker on behalf of the wool-owner at all times while in the possession of the wool-broker until payment as aforesaid.

9. Any wool may before payment therefor be rejected by the valuers, or, in case of their disagreement, by the supervising valuer, as being unmerchantable or not of the nature or quality required by the Government. Wool so rejected will not be taken by the Government.

10. In the case of all bales or packages of wool delivered in a wool-broker's store otherwise than in good condition for shipment, and in the case of bales or packages of mixed description requiring repacking, the broker shall be at liberty to charge the owner a sum not exceeding one farthing per pound for the additional work so involved, in addition to the cost of new packs, if supplied.

11. No Government wool-broker shall, in respect of any services rendered or charges incurred in pursuance of his employment by the Government as aforesaid, charge the owner of any wool with any brokerage commission or other remuneration or reimbursement, save so far as hereinbefore expressly authorized in respect of repacking, the intention being that the amount payable by the Government in accordance with the foregoing provisions shall constitute the net return to the owner for the wool as delivered into the broker's store.

12. In all of the matters herein set forth the Minister of Agriculture will act on behalf of the Government, either by himself or by such officer or officers of the Public Service as he may nominate in that behalf.

13. Sliped wool and any other quality of wool notified from time to time by the Government to the wool-brokers will not be subject to requisition under the provisions herein contained.

14. The delivery of wool by the owner to a Government wool-broker at his wool-store at any of the ports aforesaid, or the acceptance of payment from the Government in the case of wool already in any such store, shall constitute a contract between the owner and the Crown for the sale and purchase of the wool on the terms herein set forth, subject, however, to the right of rejection hereinbefore provided.

15. If any owner of wool fails or refuses to deliver such wool to a wool-broker in accordance with the foregoing provisions, or to accept payment for such wool in pursuance of these provisions, the wool will be subject to seizure in the exercise of His Majesty's prerogative in time of war, and will be disposed of in such manner as the necessities of His Majesty in respect of the present war may require.

16. All wool already shipped for export under a permit issued by the Minister of Customs in pursuance of the hereinbefore-recited Order in Council of the 18th day of November, 1916, together with all other wool theretofore shipped by or on behalf of the same owner upon the same ship, will be purchased by the Government on terms equivalent, as regards the seller, to those on which wool requisitioned under the foregoing provisions is paid for, and in accordance with valuations to be made by His Majesty's Government in the United Kingdom. In default of any such agreement for sale and purchase, such wool shall be subject to seizure on behalf of His Majesty in the manner and for the purposes aforesaid.

APPENDIX I.—WOOL-BROKERS.

Abraham and Williams (Limited).
A. Buckland and Sons.
Bennett and Sherratt.
Canterbury Farmers' Co-operative Association (Limited).
Common, Shelton, and Co. (Limited).
Dalgety and Co. (Limited).
De Pelichet, McLeod, and Co. (Limited).
Donald Reid and Co. (Limited).
Freeman R. Jackson and Co.
Friedlander Bros. (Limited).
Guiness and Le Cren.
G. W. Binney and Sons.
Hawke's Bay Farmers' Co-operative Association (Limited).
Henderson and Co. (Limited).
H. Matson and Co.
Hugh Roberts.
J. E. Watson and Co. (Limited).
J. G. Ward and Co. (Limited).
J. J. Corry and Co.
Johnston and Co. (Limited).
J. R. Mills and Son.
L. A. Nolan and Co.
Levin and Co. (Limited).
Murray, Roberts, and Co. (Limited).
National Mortgage and Agency Company (Limited).
Newton King.
New Zealand Farmers' Co-operative Association (Limited).
New Zealand Farmers' Distributing Company (Limited).
New Zealand Loan and Mercantile Agency Company (Limited).
North Auckland Farmers' Co-operative (Limited).
Otago Farmers' Co-operative Association (Limited).
Pyne and Co.
Southland Farmers' Co-operative Association (Limited).
Stronach, Morris, and Co. (Limited).
United Farmers' Co-operative Association.
Wairarapa Farmers' Co-operative Association.
W. E. Clouston and Co.
Williams and Kettle (Limited).
Wright, Stephenson, and Co. (Limited).

APPENDIX II.—SCALE OF QUALITIES AND VALUES REPRESENTING THE AVERAGE RETURNS FOR NEW ZEALAND WOOL SOLD DURING THE SEASON 1913–1914.

Description of Wool.	Range of Values per Pound according to Quality.			
		d.		d.
Superior merino combings	From	12	to	14½
Medium to good merino	"	9½	"	11½
Inferior merino	"	8½	"	9½
Superior half-bred	"	12	"	14
Medium to good half-bred	"	9½	"	12
Inferior half-bred	"	9	"	10
Superior crossbred	From	10½	to	12
Medium to good crossbred	"	9	"	11
Inferior crossbred	"	7½	"	9
Lincoln and Leicester	"	8½	"	10½
Lambs, good	"	11	"	13
Lambs, medium	"	9	"	10½

LONDON WOOL-SALES.

FOLLOWING is the High Commissioner's cabled report, dated 14th December, 1916, regarding the opening of the eighth series of London wool-sales :—

The sales have opened with strong competition and a large attendance of buyers, owing to Government purchase of the ensuing season's clip. There is great competition for all lots offering, and prices have advanced 2d. per pound, manufacturers being anxious to secure supplies before Government restrictions commence. There are 16,500 bales of New Zealand wool catalogued.

THE WORLD'S WHEAT CROP, 1916.

FOR the October issue of the Statistical Bulletin of the International Institute of Agriculture, Rome, data were available which enabled a fairly full and accurate estimate of the 1916 wheat crop of the Northern Hemisphere to be presented. The harvest of European Russia in the forty-eight Governments (out of sixty-three) in circumstances allowing the collection of statistics, amounted to 162,048,000 quintals, as compared with 203,081,000 in 1915 and 169,994,000 quintals of average yield for the five years' period 1909 to 1913. This indicates a decrease of 20·2 per cent. on the crop of 1915 and of 4·7 per cent. on the average yield. Rumania (before the enemy occupation) estimated the crop at 21,370,000 quintals, as compared with 24,436,000 in 1915 and 23,893,000, the average for 1909 to 1913—a deficient yield, seeing that the proportion of the 1916 crop as compared with that of 1915 and with the above-mentioned average is no more than 87 and 89 per cent. New estimates are given of the crop in Norway (83,000 quintals), the Netherlands (1,098,000 quintals, only 71 per cent. of 1915 crop and 82 per cent. of the average), and Egypt (9,946,000 quintals, 93 per cent. of the 1915 crop and 105 per cent. of the average). The crop in Italy is not estimated at more than 49,000,000 quintals, or 106 per cent. of the 1915 crop and 98 per cent. of the average. That of Canada, with 43,307,000 quintals, is only 42 per cent. of the crop of 1915 and 78 per cent. of the average. The United States figures are modified to 165,353,000 quintals, against 275,291,000 in 1915 and 186,889,000 on the average, or 60·1 per cent. and 88·5 per cent. respectively of the two last-mentioned quantities.

Bringing into account the yield of all countries where results are published, including Spain, England, Wales, Ireland, Italy, Norway, the Netherlands, Rumania, European Russia (forty-eight Governments), Switzerland, Canada, the United States, British India, Japan, Egypt, and Tunis, a total is arrived at of 605,687,000 quintals, against 835,820,000 in 1915, and 653,299,000 for the five years' average. The harvest, therefore, did not reach three-fourths of that in 1915, and was more than 7 per cent. below the average 1909 to 1913. The index figures of yield—in other words, the percentages of the current year's crop compared with that of 1915, and with the five years' average 1909 to 1913—are respectively 72·5 and 92·7. (In these percentages the crop of 1915 and the five years' average are each represented by 100.)

A Press cablegram from Rome, dated 29th December, 1916, quotes the latest statement of the International Institute on the world's wheat crop—namely, that the yield of sixteen countries in the Northern Hemisphere and two in the Southern is 74·7 per cent. of the 1915 yield, and 91·2 per cent. of the average from 1909 to 1914. The Argentine yield is stated as being only 52 per cent. of the past five years' average.

Dealing with the world's oat crop of 1916, the October number of the Statistical Bulletin of the International Institute of Agriculture gives new data from Norway, the Netherlands, Rumania, and European Russia, and modified figures from Italy, Canada, and the United States. Adding the above to those of Spain, England, Wales, Ireland, Switzerland, and Tunis, a total yield is estimated of 398,408,000 quintals, against 480,508,000 in 1915 and 378,424,000 on the average. The index figures for oats for these periods are 82·9 and 105·3 respectively.

OCCUPATION AND CULTIVATION OF LAND IN NEW ZEALAND.

THE following table, extracted from a compilation of agricultural statistics for the year 1915-16, issued by the Government Statistician last month, presents a summary by land districts of the areas in the Dominion under certain classes of crops, &c., and the total areas under occupation and cultivation :—

Land District.	Market Gardens, Orchards, &c.	Grain and Pulse Crops.	Grasses and Clover for Seed, Green and Root Crops.	Sown Grasses (not cut for Hay or Seed).	Fallow Land.	Plantations (not including Virgin Bush).	Total Area in Cultivation.	Area occupied by Residence and Grounds attached.	Unimproved Land (including Native Grass, *Phormium tenax*, and Standing Virgin Bush).	Total Area in Occupation.
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
Auckland ..	11,119¾	56,809¼	149,886	2,842,627½	35,153¼	31,086¼	3,126,682	10,579¼	3,319,375	6,456,636¼
Hawke's Bay ..	3,121½	39,242¾	73,361¾	2,785,928¼	3,005¾	7,070¾	2,911,730¾	4,900¾	1,457,885¼	4,374,516¾
Taranaki ..	479	12,920½	69,714½	1,172,865½	803½	20,602¼	1,277,385	3,181½	379,999¼	1,660,565¾
Wellington ..	2,630	54,415¾	102,938¼	3,212,102¾	2,554½	6,373¼	3,381,014½	8,025½	1,339,736½	4,728,776½
Nelson ..	7,988	17,226	11,340½	313,882¼	2,247¾	746¼	353,430¾	1,197¼	834,761	1,189,389
Marlborough ..	1,094¼	42,004	14,180	384,210¾	1,464¼	12,483¾	455,437	1,369¼	2,221,064¾	2,677,871
Westland ..	138¼	667¼	2,976¼	124,985¼	104¼	830¾	129,702	315½	1,555,357¼	1,685,374¾
Canterbury ..	3,543	502,278¼	293,411½	1,830,176	19,099	23,700	2,672,207¾	13,977½	5,022,912¾	7,709,098
Otago ..	4,906¾	172,797½	157,410	1,013,077¼	16,034¼	2,646	1,366,871¾	5,934¾	6,269,355	7,642,161½
Southland ..	528½	131,864¾	146,450½	880,941¾	4,182½	3,145¾	1,167,113¾	4,533	1,966,156½	3,137,803¼
Dominion totals	35,549	1,030,226	1,021,669¼	14,560,797¼	84,648¾	108,685	16,841,575¼	54,014¼	24,366,603¼	41,262,192¾

DURING RESPECTIVE MONTHS OF CURRENT AND PRECEDING SEASONS.

Month.		Mutton, Carcases.	Lamb, Carcases.	Beef, Quarters.	Pork, Carcases.	Butter, Boxes.	Cheese, Crates.	Wool, Bales.	Wheat, Sacks.	Oats, Sacks.	Rabbits, Crates.	Hemp, Bales.	Tow, Bales.	Kauri-gum, Pkgs.
January,	1916	166,700	295,170	41,726	179	108,593	101,917	92,849	..	..	..	7,438	1,666	1,218
,,	*1915*	*137,816*	*296,439*	*45,622*	*339*	*138,081*	*85,123*	*87,393*	..	..	*2,860*	*683*	..	*1,209*
February,	1916	170,973	266,414	29,056	23	96,096	84,740	96,016	..	..	..	8,161	1,804	1,900
,,	*1915*	*433,585*	*517,581*	*77,421*	*311*	*119,371*	*96,090*	*159,347*	..	..	..	*13,111*	*6,619*	*2,763*
March,	1916	327,977	363,269	83,725	..	59,671	62,082	49,750	..	..	474	2,666	637	1,247
,,	*1915*	*80,439*	*203,480*	*30,176*	..	*55,280*	*51,811*	*49,809*	..	..	..	*8,410*	*185*	*274*
April,	1916	108,488	195,707	106,369	..	24,703	81,652	41,725	..	..	..	3,782	337	450
,,	*1915*	*286,155*	*328,779*	*45,340*	..	*6,703*	*38,561*	*41,371*	..	..	*1,011*	*9,328*	*1,474*	*3,461*
May,	1916	170,164	282,156	134,971	..	26,789	56,961	26,356	..	..	1,000	2,892	235	731
,,	*1915*	*257,953*	*433,831*	*34,780*	*655*	*148*	*17,065*	*21,615*	..	..	*2,923*	*4,968*	*808*	*2,636*
June,	1916	138,303	290,319	41,593	..	10,289	18,463	22,998	..	..	5,439	5,260	2,076	1,219
,,	*1915*	*99,080*	*154,785*	*19,316*	*932*	..	*26,869*	*11,946*	..	..	*9,800*	*5,027*	*1,320*	*1,229*
July,	1916	367,827	593,670	42,322	..	4,209	30,940	50,804	..	..	10,950	9,244	3,720	3,230
,,	*1915*	*243,420*	*340,476*	*21,231*	*154*	..	*21,520*	*16,039*	..	..	*5,968*	*5,068*	*1,639*	*4,184*
August,	1916	238,926	266,390	76,755	..	9,810	32,178	18,713	3	..	9,725	7,463	1,868	3,293
,,	*1915*	*510,418*	*570,381*	*51,750*	*35*	..	*18,287*	*19,416*	..	..	*31,790*	*7,138*	*1,466*	*4,848*
September,	1916	272,848	163,852	75,422	..	185	..	6,786	7,421	..	23,445	4,494	2,428	1,123
,,	*1915*	*299,715*	*330,643*	*59,487*	..	*26,416*	*2,595*	*5,360*	..	..	*7,750*	*2,022*	*3,091*	*595*
October,	1916	190,290	132,429	60,670	..	50,667	34,459	11,600	12,596	..	11,599	8,417	5,786	2,138
,,	*1915*	*367,198*	*417,794*	*87,104*	..	*111,468*	*49,160*	*7,272*	..	..	*56,636*	*5,650*	*1,645*	*1,230*
November,	1916	168,447	218,660	26,301	..	123,181	60,277	11,772	..	..	11,495	8,571	3,523	3,953
,,	*1915*	*93,777*	*92,601*	*21,609*	..	*81,102*	*47,243*	*18,715*	..	..	*13,538*	*5,064*	*1,780*	*868*
December,	1916	94,838	201,119	3,576	..	119,155	30,492	15,401	..	..	16,244	2,933	275	1,860
,,	*1915*	*91,124*	*59,231*	*36,467*	..	*214,967*	*81,939*	*33,527*	..	..	*3,052*	*6,016*	*1,940*	*5,555*

LONDON MARKET VALUES.

COMPARATIVE STATEMENT COMPILED FROM THE HIGH COMMISSIONER'S CABLES FOR THE PAST THREE MONTHS.

London Date.	Wool. Per lb. Bradford Quotations for Tops.						Mutton. Per lb.		Lamb. Per lb.		Beef. Per lb.		Butter. Per cwt.		Cheese. Per cwt.			Hemp (Spot). Per ton.			Hemp (Forward Shipment). Per ton.			Wheat. Per qr.		Oats. Per qr.	
	36's.	40's.	44's.	50's.	56's.	60's.	Canterbury.	North Island.	Canterbury.	Other than Canterbury.	New Zealand Hinds.	New Zealand Fores.	Danish.	New Zealand.	New Zealand White.	New Zealand Coloured.	Canadian.	New Zealand Good-fair.	New Zealand Fair.	Manila Fair (New Grade).	New Zealand Good-fair.	New Zealand Fair.	Manila Fair (New Frade).	N.Z. Short-berried.	N.Z. Long-berried.	N.Z. Sparrowbills.	N.Z. Danish.
							d.	d.	d.	d.	d.	d.															
1916. Oct. 14	..	..	..	..	..	..	*8⅝	..	*9½	..	†7½	†6½	210/0	199/0	111/0	111/0	113/0	50/10/0	48/10/0	52/10/0	50/0/0	48/0/0	52/0/0	..	..	*34/6	..
" 21	..	..	..	..	..	..	*8⅝	..	*9½	..	†7½	†6½	208/0	197/0	111/0	111/0	113/0	52/10/0	50/0/0	54/0/0	52/0/0	50/0/0	53/10/0	..	..	*36/6	..
" 28	..	..	..	..	..	..	*8⅝	..	*9½	..	..	..	212/0	199/0	112/6	112/6	115/0	53/0/0	51/0/0	54/0/0	52/10/0	50/10/0	53/10/0	..	..	*37/0	..
Nov. 4	..	..	..	..	..	..	*8⅝	..	*9½	..	‡7½	‡6½	216/0	202/0	‡13/6	..	115/0	53/0/0	51/0/0	54/10/0	52/0/0	50/0/0	53/10/0	*76/	..	*38/0	..
" 11	..	..	..	..	..	..	*8⅝	..	*9½	..	7½	6¼	217/0	203/0	..	..	118/0	53/0/0	51/0/0	54/10/0	52/0/0	50/0/0	53/10/0	..	..	*40/0	..
" 18	..	..	..	..	..	..	*8⅝	..	*9½	..	..	..	216/0	..	..	..	122/0	53/0/0	51/0/0	55/0/0	52/0/0	50/0/0	54/0/0	..	..	*41/0	..
" 25	..	..	..	..	..	..	*8⅝	..	*9½	..	7	6	219/0	..	..	..	127/0	53/0/0	51/0/0	56/10/0	52/0/0	50/10/0	56/0/0	..	..	*41/0	..
Dec. 2	..	..	..	..	..	..	*8⅝	..	*9½	..	7¼	6¾	219/0	..	..	..	127/0	54/0/0	52/0/0	58/0/0	53/0/0	51/0/0	57/0/0	..	..	*46/0	..
" 9	..	..	..	..	..	..	*8⅝	..	*9½	..	7⅜	7¼	221/0	211/0	..	..	131/6	54/10/0	52/10/0	58/10/0	54/0/0	52/0/0	57/10/0	..	..	*48/0	..
" 16	..	..	..	..	..	..	*8⅝	..	*9½	..	7⅜	7	221/0	215/0	..	..	133/6	59/5/0	55/0/0	60/0/0	56/0/0	53/0/0	59/0/0	..	..	*48/0	..
" 22	..	..	..	..	..	..	*8⅝	..	*9½	..	..	..	221/0	215/0	..	..	133/0	58/0/0	55/0/0	59/10/0	54/0/0	52/0/0	58/0/0	*80/	..	*50/0	..
" 29	..	..	..	..	..	..	*8⅝	..	*9½	..	..	..	219/0	213/6	..	..	..	..	..	..	..	..	..	..	..	..	..
1917. Jan. 6	..	..	..	..	..	..	*8⅝	..	*9½	..	..	..	218/0	208/0	..	..	134/6	60/0/0	58/0/0	..	59/0/0	57/0/0	60/0/0	*80/	..	*50/0	..
" 13	..	..	..	..	..	..	*8⅝	..	*9½	..	†8	†7	219/0	205/0	..	..	139/0	60/0/0	58/0/0	62/0/0	59/0/0	57/0/0	60/0/0	..	..	*50/0	..

STOCK EXPORTED.

THE following table shows the numbers and descriptions of stock exported from the Dominion during the month of December, 1916:—

Port of Shipment.	Horses.		Sheep.			Cattle.		Pigs.	
	To Australia.	To Eastern Pacific.	To Australia.	To Eastern Pacific.	To San Francisco.	To Australia.	To Eastern Pacific.	To Eastern Pacific.	To Australia.
Auckland ..	..	14	..	89	..	..	..	38	..
Gisborne ..	..	..	..	..	..	..	..	..	..
Napier ..	..	..	..	..	..	..	..	..	..
Wellington ..	..	..	..	65	..	..	..	..	..
Lyttelton ..	..	..	202	..	..	..	..	..	..
Dunedin ..	..	..	..	..	..	..	..	..	..
Bluff	..	..	..	..	..	..	..	..	..
Totals ..	..	14	202	154	..	..	..	38	..

The following are particulars of horses shipped: 10 draught geldings, 1 trotting stallion, 3 pony mares.

STOCK IN QUARANTINE.

THE following stock was received into quarantine during the month of December, 1916:—

No.	Description.	Sex.	Port of Origin.	Owner or Agent.	Address.
			MOTUIHI ISLAND (AUCKLAND).		
1	Pomeranian dog	Male ..	London ..	T. Walters ..	Western Australia.
			SOMES ISLAND (WELLINGTON).		
3	Romney Marsh rams	Male..	London ..	N.Z. Loan and Mercantile Agency Company	Wellington.
1	White poodle dog	..	San Francisco (via Sydney)	S. T. Bevis ..	Sydney.
			QUAIL ISLAND (LYTTELTON).		
1	Shorthorn bull..	Male ..	London ..	Hon. R. McNab ..	Knapdale.
1	Collie dog ..	,, ..	,, ..	J. Lilico ..	Lochiel.

The

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WELLINGTON, NEW ZEALAND.

20TH FEBRUARY, 1917.

AGRICULTURAL INSTRUCTION.

THE CENTRAL DEVELOPMENT FARM, WERARAOA.

F. S. POPE, Secretary of Agriculture.

IT seems desirable to call further attention to the recent announcement of the Hon. W. D. S. MacDonald, Minister of Agriculture, in regard to the conversion of the Department's Weraroa Experimental Farm into a Central Development Farm for the Dominion.

It is sometimes felt by officers of the Department that farmers and others concerned do not take the interest that might be expected in proposals put forward for their benefit. While there is perhaps a certain amount of blame fairly attributable to our settlers in this respect, I believe that in most cases the apparent lack of interest is due to the fact that the proposals are not brought sufficiently before, and explained to, those concerned. The object of these notes is to take agriculturists and pastoralists

more fully into the Department's confidence as regards the Central Development Farm and its objects and possibilities.

DEFECTS IN EXISTING SCHEMES.

Experience has shown that there are several awkward breaks in the existing schemes of agricultural education and development. These may be briefly set out as follows :—

(1.) The children in a large number of the primary schools are now being given a first insight into agricultural affairs by means of nature-study and the school-garden. On reaching the district high school or other secondary school with an agricultural side they receive an elementary training in the principles of some of the sciences underlying agricultural and pastoral work, and for this purpose further use is made of school-gardens, a few of which might fairly be called miniature farms. In several instances the officers of the Department of Agriculture have given help in setting out suitable experiments and lines of practical work in these secondary-school plots in co-operation with the school instructors. The result of all this is that a fair number of boys are now leaving these secondary schools with an appreciable knowledge of agricultural science. Here, however, one of the breaks referred to occurs. Unless the pupil is a lad in a position to take a course at the Canterbury (Lincoln) Agricultural College there is no provision for carrying his studies further along farming lines. The consequence is that if a pupil does not go straight from the secondary school to actual farming-work his agricultural training is to a large extent wasted.

(2.) In the past a fair amount of demonstration and experiment in connection with agricultural and pastoral problems has been carried out at the Department's experimental farms, and much good has accrued to those farmers who have been able to spend a reasonable length of time at these institutions in order to have the demonstrations and experiments fully explained to them by the resident officers. The number of such farmers has, however, been all too small, and therefore many of the truths that have been illustrated or ascertained by the demonstrations and experiments have remained unknown to the majority of those for whose benefit they were carried out.

(3.) Even the Department's own officers—Fields Supervisors, Fields Inspectors, and so on—have not been in a position to obtain the full benefit of the work of the experimental farms, and therefore have not been able to carry the results to the settlers to anything like the extent that is desirable.

(4.) The Department of Agriculture has had almost no means of training young men for positions such as those just enumerated, and appointments in such capacities have had to be made from men possessing good all-round knowledge of farming as carried on in New Zealand, but without the special training that would fit them to become the ideal guide, philosopher, and friend of farmers in their districts.

(5.) There has been up till now no institution, excepting the Canterbury Agricultural College (where appreciable fees have to be paid), available for the training of men to occupy the positions of agricultural-science masters in secondary schools, or of itinerant agricultural instructors to guide and direct the work of other teachers in district high schools or primary schools who have to instruct their pupils in agriculture or nature-study tending towards agriculture.

(6.) Still another blemish in the existing schemes has been that the lads accepted as "learners" at the Department's experimental farms have been able to receive little more than what might have been expected from a farm school — namely, tuition as to the proper methods and times of carrying out the ordinary agricultural operations, such as ploughing, harrowing, reaping, stacking, shearing, docking, milking, milk-testing, stock-feeding, pruning, spraying, poultry-keeping, beekeeping, and so on. The lads coming to the experimental farms have, however, been of such a class as would probably have profited by a somewhat higher level of training, their parents' intention being in many cases to buy farms for them or to obtain them places as farm-managers, in which circumstances they would, as a rule, require more than a farm-school training to be thoroughly successful.

OBJECTS OF THE CENTRAL DEVELOPMENT FARM.

The Central Development Farm is intended as the main factor in a system designed to overcome all these difficulties. It is proposed to undertake (*a*) demonstrations of truths already ascertained in connection with agricultural, pastoral, and dairying operations; (*b*) carefully considered sets of experiments to determine points on which information is needed in regard to those subjects; (*c*) extended research involving perhaps many series of experiments, much laboratory work, and the study of all available literature bearing on the research; (*d*) the training of a number of suitably educated students as agricultural and pastoral experts, whether for the service of this Department, for the teaching of agriculture in secondary schools, or for actual farm-management.

With regard to paragraph (*c*), it is perhaps advisable to explain that researches will have to be undertaken from time to time as men and money for the work can be found. These researches will, unlike ordinary experiments, not be designed to merely ascertain a few definite facts, but will seek to discover whatever can be found out in regard to the subject of the research. For example, a research concerning the sowing of bush-burns might require numbers of sets of field experiments, biological and chemical laboratory work, the obtaining of many reports from officers and others throughout the Dominion, the employment of a number of scientific officers dealing with different aspects of the matter, and the expenditure of a good deal of money. It will be seen that such a research might not succeed in absolutely determining the best grasses for general use on bush-burns, but might easily bring to light much valuable information in regard to points not hitherto cleared up. Similarly, a research rega ding phormium hemp would involve such points as the varieties of the plant yielding the most fibre, or the best fibre; those most resistant to pests; those most suited to wetter or drier conditions; and so on. It would also require experiments in regard to the utilization of, or extraction of valuable constituents from, the by-products; as to methods of extracting the fibre; and concerning the advantages of cultivating the land growing the plants; and so forth.

I have not attempted to give complete descriptions of researches on these two matters, and I do not mean to indicate that either of these subjects will necessarily be dealt with at Weraroa in the comparatively near future. My intention is simply to give an idea of the sense in which the word "research" is used. Intelligent farmers will be able to appreciate what is meant, and perhaps to give valuable suggestions as to lines for experiment or research in the future. It must, however, be kept continually in view that at first we shall have very few trained men, and that the present time is unfavourable for any advance requiring the expenditure of large sums of money.

STAFF.

It will be obvious that for carrying on these demonstrations, experiments, and researches, and the training of the students, a number of highly qualified agricultural scientists are ne essary; and I am confident that those farmers who have had dealings with Mr. J. Brown, B.Sc.Ag., N.D.A., Director of the Fields Division; Mr. A. H. Cockayne, our Biologist; and Mr. A. McTaggart, M.S.A., our Agriculturist, will be glad to know that it is intended to

locate them at the Central Development Farm. An agricultural chemist, a live-stock husbandman, and other officers will also be appointed. Two additional residences are about to be built on the farm, so that these officers may always be in close contact with the work and the students.

While on the subject of the staff of the Central Development Farm, it should be mentioned that it is by no means improbable that the military ballots will before long claim some if not all of the professional officers available for carrying on the work. When any of those officers is chosen by ballot i will be a matter for earnest consideration by the proper authorities wh ther the interests of the Dominion, or rather of the Empire, will be best served by his going to the front or by his continuing to carry on the nationally important work at Weraroa.

OPPORTUNITIES FOR STUDENTS.

It will be recognized that the position of a student at the Central Development Farm offers an exceptional opportunity to a young man, especially to one who has had ordinary farm training and some education in agricultural science; and in order to give an assured future to the students it has been decided, with the approval of the Public Service Commissioner, that when appointments are being made to the professional staff of the Department of Agriculture men who have been through a course of training at Weraroa will be given special preferen e. It will thus be seen hat lads who have taken an agricultural course at district high schools or secondary schools where agriculture is made a feature will have a definite career open to them, instead of, as hitherto, finding themselves at a loose-end on completion of their secondary course.

It is hoped that later on arrangements will be made for the best of these students to take a course in agricultural science at the University, thus enabling them to secure the hall-mark of a degree in agriculture. Before this could be done it would, of course, be necessary for the University to recognize the training at Weraroa in the same way that work at Lincoln College is now accepted. I am confident that when the Central Development Farm is in full going order there will be no difficulty in obtaining such affiliation to the University.

BURSARIES AND STUDENT-ASSISTANTSHIPS.

I trust that after reading the foregoing many settlers will be eager to know how their sons can secure the advantages of a

course of instruction at the Central Development Farm. There are two means by which this may be done. The Education Department has published an offer* of a number of bursaries of a value equivalent to £20 per annum, with free board and lodgings. These are open to young men who have taken a secondary course in agricultural subjects, and have passed the Matriculation examination. Full particulars can be obtained from the Director of Education, Wellington. The other means of entering Weraroa is by applying to the Director of the Fields Division, Department of Agriculture, Wellington, for an appointment as a student assistant, the commencing salary for which is also equal to £20 per annum, with free board and lodgings. Applicants should, if possible, give evidence of a successful course at a secondary school by producing a "leaving certificate," which can be obtained through the headmaster of the school. Preference will be given to lads who have studied chemistry, botany, physics, or other sciences bearing upon agriculture, and, other things being equal, lads brought up in the country will be chosen.

DISSEMINATING KNOWLEDGE FROM THE CENTRAL DEVELOPMENT FARM.

Turning now to the matter of disseminating throughout the Dominion the results of the demonstrations, experiments, and researches at Weraroa, this will be accomplished by conjoining the work of the Department's other experimental farms, agricultural stations, &c., throughout the Dominion with that of the Central Development Farm, also by associating the Fields Supervisor in each district with one of these institutions, and by arranging for frequent visits of the Fields Supervisors to Weraroa, and of the Fields Inspectors to the experimental farms, agricultural stations, &c., in their own locality. Visits by farmers to any of these establishments will be welcomed, as hitherto, but those who are unable to pay a visit will be able to derive much benefit from the advice and assistance of the officers referred to. Publicity, of course, will also be secured through the *Journal of Agriculture.*

CONCLUSION.

In this article it has not been sought to deal expansively with the subject, but it is hoped that settlers will now have a clearer conception of the means by which the Minister of Agriculture proposes to help them through the medium of the Central Development Farm and the organization radiating therefrom.

* Reprinted elsewhere in this issue of the *Journal*.

TESTING OF PUREBRED DAIRY COWS.

THE CERTIFICATE-OF-RECORD SYSTEM IN 1916.

W. M. SINGLETON, Assistant Director, Dairy Division.

DESPITE the abnormal war conditions under which dairy-farming is now being prosecuted in New Zealand the support accorded during the past year by breeders to the certificate - of - record testing of purebred dairy cows has been most gratifying. A number of new breeders have started cows on test, but the shortage of labour has restrained many others from commencing or continuing this line of endeavour. Further, the cost of all concentrated feeds not grown on the dairy farms has been so high that it has been necessary for cows under test to depend more on grass than during former seasons. These and other circumstances have had an inimical influence on the testing. Nevertheless, the past year's results bear evidence of the permanency of the work, and suggest a considerable forward movement when conditions become somewhat normal.

Ruskin states that "where investigation is necessary, teaching is impossible." Our purebred cattle in New Zealand represent a field where investigation is proving fruitful. We have in the Dominion some strains probably as good as any in the world, while we also have other strains which compare unfavourably. Investigation is necessary to learn the respective merits of each strain, and such a need is being met by our C.O.R. testing-system.

CERTIFICATES ISSUED.

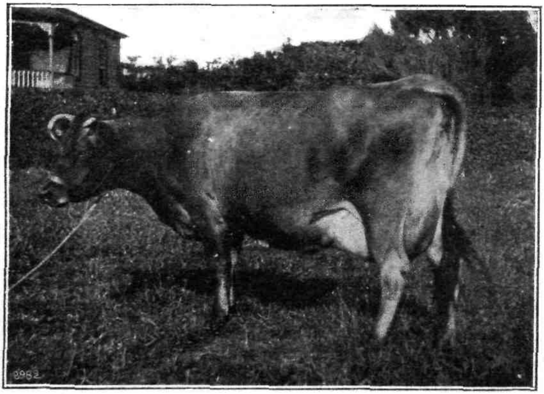
During the year under review certificates were issued on the production of 154 new cows and to 16 on retests. To facilitate comparison with previous years' results the comparative numbers are set out in tabular form below. Certificates are now held by owners on the records of 624 stud cows; 55 repeat certificates have also been issued. These numbers do not appear large when compared with the number of dairy herds in New Zealand. It must not be overlooked, however, that New Zealand is only a young country, and that while the number of C.O.R. cows could be much larger, and will be so in time, our proportion of purebred cows tested and of breeders testing will bear favourable comparison with that of longer-settled countries.

Since the commencement of the semi-official testing-system certificates have been issued to 356 Jerseys, 221 Friesians, 38 Ayrshires, and 9 milking Shorthorns. The following table shows the number of certificates issued during each calendar year:—

Breed.	1913.	1914.		1915.		1916.	
		Ordinary.	Repeat.	Ordinary.	Repeat.	Ordinary.	Repeat.
Jersey ..	67	104	14	91	3	94	11
Friesian ..	48	67	11	62	9	44	5
Ayrshire ..	..	17	1	12	1	9	..
Shorthorn ..	..	..	..	2	..	7	..
Totals ..	115	188	26	167	13	154	16

JERSEYS.

In only one Jersey class is there a new leader for 1916, but the performance concerned is of such outstanding merit that fanciers of the breed have reason to feel satisfied. The 1915 leader of the



TOPSY'S NUGGET.
Holder of highest Mature Jersey record for 1916.

class under three years old was Hillcrest Hope, owned by E. S. Lancaster, Levin. Hillcrest Hope produced 616·50 lb. of butter-fat. During 1916 this heifer was beaten with 650 lb. of fat produced

by Lady Peggy, bred and tested by Mr. E. Griffiths, New Plymouth. For a short time Lady Peggy held the honour of class-leader, but later was displaced by the splendid record of Mere, bred and owned by Mr. F. S. McRae, of Palmerston North. Mere, although in the class under three years, actually started her test while under two years, and produced in 365 days the phenomenal record of 663·64 lb. fat, or just 100 lb. of fat behind the leader of the mature class, Madam Mayflower, who has a credit of 763·41 lb. fat. Charm, the granddam of Mere, was the 1914 leader of the four-year-old class, with a credit of 572·52 lb. fat. Mere's yield places her as not only leader of the New Zealand Jersey two-year-old class, but also distinguishes her as the world's premier dairy yearling, and Mr. McRae is to be congratulated on bringing such an honour to the Dominion.*

The leaders of the several Jersey classes are as follows, similar particulars for 1915 being also given for purposes of comparison :—

Name of Cow and Class.	Tested by	Age at starting Test.		Fat req'd for Cert.	Yield for Season.		
					Days.	Milk.	Fat.
	1916.						
		Yrs.	dys.	lb.		lb.	lb.
Two-year-old. Mere	F. S. McRae, Palmerston North	1	346	240·5	365	12,164·00	663·64
Three-year-old. Belvedere Sungleam	E. B. Eagle, Carterton	3	329	309·9	365	11,044·80	626·46
Four-year-old. Lady of Collingwood	F. E. Hellyer, Dunedin	4	86	322·1	365	12,096·50	736·07
Mature. Madam Mayflower ..	H. B. Curtis Estate, Inglewood	5	307	350·0	365	11,793·20	763·41
	1915.						
Two-year-old. Hillcrest Hope ..	E. S. Lancaster, Levin	2	214	261·9	365	10,733·90	616·50
Three-year-old. Belvedere Sungleam	E. B. Eagle, Carterton	3	329	309·9	365	11,044·80	626·46
Four-year-old. Lady of Collingwood	F. E. Hellyer, Dunedin	4	86	322·1	365	12,096·50	736·07
Mature. Madam Mayflower ..	H. B. Curtis Estate, Inglewood	5	307	350·0	365	11,793·20	763·41

The Jersey two-year-old class was very large, and the splendid total of fifty-six certificates was issued. The average production

* A photograph of Mere and a special account of her performance were published in the *Journal* for October, 1916.

of the class shows a slight decrease from the 1915 average, but is still considerably in advance of the 1914 average. Reference has been made above to the records of Mere and Lady Peggy, each having gone a good way toward maintaining the prestige of the class-average. These two leaders were also well supported by such records as those of Waipiko Myrtle, with 562·49 lb. of fat; Snow Queen's Fancy, with 562·05 lb.; Belvedere Sunray, with 538·94 lb.; and Golden Swan's Lady, with 515·50 lb. Twenty-six breeders were represented in this class, ten of whom appear in our list for the first time. A number of these have only recently commenced breeding purebred Jerseys, and more is likely to be heard from them in years to come. The two-year-old Jersey class is certainly a credit to the breed, and the Jersey Cattle Breeders' Association may well look forward with confidence to the future.

The Jersey three-year-olds have received practically the same number of certificates during the past year as during the preceding period. The average yield of the cows in this class has also receded somewhat. During 1915 there were included three young cows with records exceeding 600 lb. of butter-fat. The past year has no representative in the 600 lb. list, but good work was done by Frisky Goldie, with 569·81 lb. of fat; Golden Swan's Girl, with 563·55 lb.; Snow Girl, with 557·12 lb.; and Eminent's Sherry, with 554·10 lb.

Nothing came forward in the four-year-old class to endanger the leadership established by Lady of Collingwood in 1915. The average production of this class has also receded a little; and it may be accepted that many of the past year's records in this and other classes were produced, to a very large extent, under conditions that the average dairyman would describe as normal. The records of outstanding merit amongst the four-year-olds include those of Sultan's Lass, with 580·40 lb. of fat; Flandrine's Gift, with 544·75 lb.; and Snow Bird, who calved prematurely after producing, in 316 days, 468·09 lb.

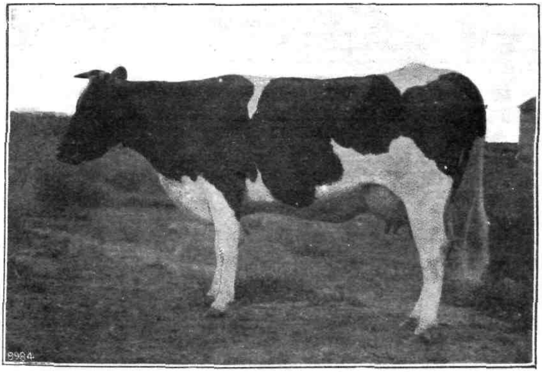
Mr. J. E. Gavey has the honour of having owned and tested the only mature cow exceeding 600 lb. fat, Topsy's Nugget (illustrated) producing 617·66 lb. fat. Sybil See on her retest was expected to demonstrate her claim to the 600 lb. class, but just missed it with a C.O.R. for 595·32 lb. of fat. Her first record was 409·30 lb. of fat as a two-year-old. Lady Starlock in the mature class also put up a splendid performance, her C.O.R. being for 588·79 lb. of fat. The number of certificates granted in this class was practically the same as for the preceding year, and appears very satisfactory when all conditions likely to influence such work are considered.

The Jersey class-averages are as follows :—

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
	1916.		lb.	lb.
Two-year-old	56	336	6,336·77	356·95
Three-year-old	20	348	8,061·87	430·60
Four-year-old	11	356	8,325·40	444·67
Mature	18	341	8,143·10	443·80
	1915.			
Two-year-old	39	343	6,581·93	370·81
Three-year-old	22	354	7,767·46	448·45
Four-year-old	14	335	8,571·80	470·13
Mature	20	349	8,837·19	490·79

FRIESIANS.

Class-leaders for this breed have been fairly steady in 1916, although a change in two classes bears evidence to no stalemate condition.



ETHEL OF FRIESLAND PARK.
Leader of the Junior Three-year-old Friesians.

In the junior three-year-old class Ethel of Friesland Park (illustrated), owned and tested by Mr. F. W. Koberstein, of Taonui, Feilding, has a credit for 638·85 lb. fat; and to this record Mr. G. Aitchison's Gladys II, with her 614·00 lb., has to give place. Burkeyje Sylvia Posch, owned and tested by Messrs. H. North and Sons, Omimi, Seacliff, with 610·42 lb., was a close competitor with Gladys II.

The junior four-year-old class has had a change of leader. Annette V of Brundee, who was last year's leader with 545·30 lb. fat, and has held pride of place since 1914, had this year to strike her colours to Meta (illustrated), who was bred and tested by Mr. G. Aitchison. As will be seen, Meta's record of 675·06 lb. fat shows a considerable increase over that of the class-leader for 1915. Meta milked only 346 days, which makes her record all the more creditable.

The Friesian class-leaders for the last two years are as follows :—

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat
	1916.	Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old. Lady of Cliftside II ..	W. I. Lovelock, Palmerston North	2 117	252·2	365	16,320·50	535·22
Senior Two-year-old. Netherland Princess IV	J. Donald, Westmere	2 341	274·6	365	19,621·60	805·77
Junior Three-year-old. Ethel of Friesland Park	F. W. Koberstein, Taonui	3 37	280·7	365	17,663·20	638·85
Senior Three-year-old. Manor Beets Daughter II of Ashlynn	C. A. Hopping, Palmerston North	3 296	306·6	365	18,733·90	863·51
Junior Four-year-old. Meta	G. Aitchison, Kaitangata	4 24	315·9	346	18,285·75	675·06
Senior Four-year-old. Grace Fayne of Ashlynn	C. A. Hopping, Palmerston North	4 302	343·7	351	17,934·00	716·05
Mature. Holland Queen ..	A. J. Gallichan, Tiakitahuna	5 52	350·0	365	20,629·90	755·78
	1915.					
Junior Two-year-old. Lady of Cliftside II ..	W. I. Lovelock, Palmerston North	2 117	252·2	365	16,320·50	535·22
Senior Two-year-old. Netherland Princess IV	J. Donald, Westmere	2 341	274·6	365	19,621·60	805·77
Junior Three-year-old. Gladys II	G. Aitchison, Kaitangata	3 155	292·5	304	15,788·25	614·00
Senior Three-year-old. Manor Beets Daughter II of Ashlynn	C. A. Hopping, Palmerston North	3 296	306·6	365	18·733·90	863·51
Junior Four-year-old. Annette V of Brundee	W. H. Bayliss, Mangatainoka	4 112	324·7	330	14,401·00	545·30
Senior Four-year-old. Grace Fayne of Ashlynn	C. A. Hopping, Palmerston North	4 302	343·7	351	17,934·00	716·05
Mature. Holland Queen ..	A. J. Gallichan, Tiakitahuna	5 52	350·0	365	20,629·90	755·78

The junior two-year-olds formed the largest class for the year, and numbered two less than for the preceding year. The present class-leader qualified in 1915, and her yield, together with those others over 500 lb. fat, probably go a long way to accounting for the 1915 class-average being some 5 lb. of fat higher than that of 1916. During 1916 only one animal in the junior class holds the distinction of having produced over the 500 lb. fat mark. This was Domino's Friesland Belle, with a C.O.R. for 533·48 lb. fat, who was bred and tested by Mr. W. I. Lovelock, of Palmerston North.

While all the records in the senior two-year-old class are creditable, the average cow of the class has yielded some 6 lb. butter-fat less than during 1915. The only 500 lb. cow in this class is Monavale Nobeltje Veeman, an illustration of whom was given in the November issue of the *Journal*. This cow was bred and tested by Mr. C. C. Buckland, of Cambridge.

The junior three-year-old class shows a substantial increase in the yield of the average cow over that of 1915. The new class-leader, Ethel of Friesland Park (illustrated), with a C.O.R. for 638·85 lb. fat; Burkeyje Sylvia Posch, with 610·42 lb.; and Lady Tirania de Kol II, with her 551·64 lb., would contribute materially to the increase.

The senior three-year-old class evidences a distinct drop in the numbers of C.O.R. cows, only five appearing this year, against sixteen for the preceding year. Not only have the numbers decreased, but the record of the average cow, although high, does not attain to the very high average of 1915. Each cow of the 1916 quintette produced well, the records being from about 140 lb. to 260 lb. fat above the respective standards. Salma Johanna Lyons and Mutual Maggie of Rock were the only cows to attain 500 lb. fat, and while their records are good they are not enough to enable the 1916 class to compete favourably with the 1915 list, which contained the records of Manor Beets Daughter II of Ashlynn, with 863·51 lb. fat; Dutchland Colantha Mercedes, with 756·99 lb.; Lady Kathleen, with 641·16 lb.; Lady Mooie Blanco IV of Ashlynn, 626·06 lb.; and Dominion Woodcrest de Kol Cornella, who on twice-a-day milking produced 583·30 lb. fat.

Meta, having become the new junior four-year-old class-leader with 675·06 lb. fat, seconded by Heilo Oak Burk Lyons with 341·12 lb., has brought the average production of the class to about 83 lb. fat higher than that of the previous year.

The mature class dropped considerably in the number of cows tested, but the average yield is slightly increased. The highest C.O.R. cow is Mr. G. Aitchison's Virginia, with a credit of 652·91 lb. fat. Glendowie Cornflower, owned by Mr. C. C. Buckland, comes next with 545·04 lb., and is closely followed by Dominion Mutual Mercedes of Rock, with a record of 529·76 lb.

The Friesian class-averages are as follows :—

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
	1916.		lb.	lb.
Junior two-year-old ..	16	351	10,978·78	390·40
Senior two-year-old ..	7	357	11,525·63	416·91
Junior three-year-old ..	8	328	13,193·40	448·17
Senior three-year-old ..	5	323	14,369·40	494·50
Junior four-year-old ..	2	300	14,733·67	508·09
Senior four-year-old ..	5	325	12,103·68	407·98
Mature	6	342	13,561·79	492·76
	1915.			
Junior two-year-old ..	18	350	11,010·39	395·07
Senior two-year-old ..	9	345	11,893·70	423·37
Junior three-year-old ..	7	345	11,894·20	395·00
Senior three-year-old ..	16	341	13,303·11	510·19
Junior four-year-old ..	2	325	12,816·65	425·30
Senior four-year-old ..	4	361	14,251·30	496·20
Mature	15	346	13,507·93	490·93

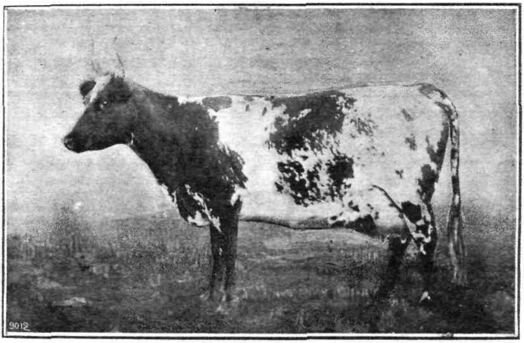
AYRSHIRES.

Very few Ayrshires completed their test during the period under review, but the records of those qualifying for certificates are almost without exception very creditable indeed.

The two-year-old class finds a new leader in Kanadale Linda, with a credit of 502·55 lb. fat. This young cow was bred and tested by Messrs. Cockburn Bros., of Mataura, Otago. Kanadale Linda's dam, commencing in her eleventh year, produced 468 lb. fat. The sire of Kanadale Linda was imported.

The class for three-year-olds also claims a new leader in Adelaide II of Waipapa (illustrated). This cow was tested by Mr. F. Mills, of Waipapa, Hawera. It will be remembered that Mr. Mills last season secured the breed's highest certificate of record with Alexandra of Waipapa, who produced 591·16 lb. fat as a four-year-old. Mr. Mills now has the honour of possessing two class-leaders in his herd. Adelaide II of Waipapa displaces as leader Kanadale Fanny, bred and tested by Messrs. Cockburn Bros.

The mature class was led for some time by Minnie of Glenweir, owned by Messrs. Weir Bros., Pukehiki, Dunedin. During 1916 Flossie of Koputaroa, owned by Mr. C. E. C. Webb, made the nice record of 571·48 lb. fat in 358 days, and calved again within the year. Had this cow calved a month or six weeks after her 365-day period she would doubtless have yielded over 600 lb. fat. In the mature class also appear two other fine records. Dolly of Inglewood, owned and tested by Mr. F. Mills, has a credit of 513·18 lb. fat, and Daisy II of Hagbourne, owned and tested by



ADELAIDE II OF WAIPAPA.

Leader of the Three-year-old Ayrshires.

Mr. C. Woodley, of Newbury, Palmerston North, has a credit of 467·42 lb. fat in 325 days. It is considered that quite a number of purebred Ayrshire cows could produce equally creditable records were they tested and given such treatment as would enable them to produce their maximum.

Only a few Ayrshire breeders have supported the testing, and the good work done by these is doubtless the greatest effort being put forward to hold the fort for the breed. These few breeders have done well, but great assistance could be given the breed if the number of C.O.R. cows of good production was increased.

Following are the Ayrshire class-leaders :—

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	1916.					
		Yrs. dys.	lb.		lb.	lb.
Two-year-old. Kanadale Linda ..	Cockburn Bros., Mataura	2 348	275·3	365	12,583·00	502·55
Three-year-old. Adelaide II of Waipapa	F. Mills, Waipapa, Hawera	3 321	309·1	365	11,604·20	426·68
Four-year-old. Alexandra of Waipapa	F. Mills, Waipapa, Hawera	4 348	348·3	365	14,348·60	591·16
Mature. Flossie of Koputaroa	C. E. C. Webb, Koputaroa	8 348	350·0	358	13,733·80	571·48
	1915.					
Two-year-old. Bluebell of Glenweir	Weir Bros., Pukehiki, Dunedin	2 355	276·0	365	8,214·40	371·02
Three-year-old. Kanadale Fanny ..	Cockburn Bros., Mataura	3 294	306·4	314	8,918·80	361·49
Four-year-old. Alexandra of Waipapa	F. Mills, Waipapa, Hawera	4 348	348·3	365	14,348·60	591·16
Mature. Minnie of Glenweir ..	Weir Bros., Pukehiki, Dunedin	6 11	350·0	363	11,471·10	528·92

The Ayrshire class-averages are as follows :—

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
	1916.			
			lb.	lb.
Two-year-old	4	351	8,985·50	350·08
Three-year-old	1	365	11,604·20	426·68
Four-year-old*	..	..	..	..
Mature	4	346	11,428·60	479·65
	1915.			
Two-year-old	3	335	7,555 40	324 87
Three-year-old	1	302	10,952·10	360·34
Four-year-old	3	349	11,199·10	437·02
Matu'e	7	344	10,894·60	462·19

* No cows of this class qualified for C.O.R. during 1916.

SHORTHORNS.

The latest breed to commence semi-official testing was the milking Shorthorn. During 1915 certificates were issued on the production of two cows, owned and tested by Mr. E. Law, of Shannon. During 1916 five breeders received certificates on the production of seven cows. Only two-year-olds and mature cows have been represented in the certificate list thus far; consequently Joyse II

of Hillview, owned by Mr. J. C. Wright, of Matapu, Hawera, became leader of the two-year-old class, and Mr. J. R. Anderson's Beauty headed the mature class.

The records of all the Shorthorn C.O.R. cows for 1916 are as follows:—

Cert. No.	Name of Cow.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
					Days.	Milk.	Fat.
			Yrs. dys.	lb.		lb.	lb.
3	Beckfield Flora of 1912	W. Gibson, Feilding ..	2 111	251·6	365	7,189·85	264·14
4	Joyse II of Hillview	J. C. Wright, Matapu	2 215	263·0	365	9,860·00	365·34
5	Fancy ..	R. Turnbull and Sons, Sentry Hill	6 316	350·0	365	10,527·00	423·62
6	Myrtle ..	R. Turnbull and Sons, Sentry Hill	9 44	350·0	365	10,268·10	362·14
7	Beauty ..	E. Law, Shannon ..	*	350·0	324	7,800·00	365·73
8	Nancy ..	E. Law, Shannon ..	7 347	350·0	365	11,314·25	471·72
9	Beauty ..	J. R. Anderson, Tiakitahuna	†	350·0	365	13,477·20	551·24

* About 8 years. † Mature.

C.O.R. BULLS.

During the year nine bulls (six Jerseys and three Friesians) have qualified for the special list requiring a minimum of four C.O.R. daughters, each from different dams. Bulls also which had qualified prior to 1916 have added to their laurels through an increased number of daughters with a C.O.R.

The outstanding increases amongst the C.O.R. daughters of Jersey bulls are claimed by K.C.B., with eight additional; by Eminent's Fontaine, with six; and by Majesty's Fox, with three extra. This places these bulls considerably ahead of others of the breed. K.C.B. was not young when C.O.R. testing commenced, and he died a year ago. Other daughters of his will probably come on test, but it is doubtful if he can maintain his precedence, since Eminent's Fontaine and Majesty's Fox are younger and already have a considerable number of C.O.R. daughters to their credit. Further, both these latter bulls are owned by Mr. C. G. C. Dermer, who without doubt will give their progeny requisite opportunity of demonstrating their productive powers.

Among the Friesian bulls three new names appear, and, of the bulls previously qualified, Cliffside Laddie and King Segis Wild Rose Homestead have a considerable increase in their number of C.O.R. daughters. Daughters of each of these two bulls have been tested largely by Mr. W. I. Lovelock, who has used them as heads for his herd, and now retains King Segis Wild Rose Homestead in that position. A number of the pedigrees sub-

mitted by Mr. Lovelock to prospective buyers doubtless include the names of both Cliffside Laddie with eleven C.O.R. daughters, and King Segis Wild Rose Homestead with ten such daughters. Such figures add mate.ially to the strength of a pedigree. The following list gives the names of all C.O.R. bulls, together with the number of their daughters which have received certificates :—

JERSEYS.

	Number of C.O.R. Daughters.		Number of C.O.R. Daughters.
K.C.B.	19	Pride of Egmont	5
Eminent's Fontaine	16	Frisky Campanile	5
Majesty's Fox	13	Good Luck	4
Starbright	9	M.H.R.	4
M.L.C.	8	Glory	4
Blizzard	7	**Rozel's Sultan*	7
Campanile's Sultan	6	*Roberts	6
Stevenson	6	*Grand Duke	5
Goddington	6	*Silver King (Stuckey's)	5
Golden Swan	6	*Brighton Twylish	4
Lord Lepperton	5	*Young Emperor III	4

FRIESIANS.

Sir de Kol *Inka Pietertje*	13	*Edinglassie*	5
Cliffside Laddie	11	Colonel Manor of Riverside	5
King Segis Wild Rose Homestead	10	Netherland King	4
Nazli de Kol	10	Colantha Johanna Lad	4
Grace's Netherland of Riverside	9	*Mutual Piebe de Kol	6
Paul Pietertje	8	**De Kol Pontiac Burke*	6
Kruger II	6	*Pietertje Boy	4
Longbeach Van Tromp	6		

AYRSHIRES.

King Cole	5

* Qualified during 1916.

APPRECIATION.

In concluding this review of the past year's semi-official testing-work we wish to express our thanks for, and appreciation of, the assistance rendered us by the secretaries of the New Zealand Friesian Association, the New Zealand Jersey Cattle Breeders' Association, the New Zealand Ayrshire Cattle Breeders' Association, and the New Zealand Milking Shorthorn Association, all with headquarters at Palmerston North. During each year a considerable amount of correspondence passes between the Dairy Division of the Department and the officia's mentioned, all of whom have assisted materially towards facilitating the conduct of the work. It will be clear from figures quoted hereinbefore that the bulk of the clerical duties to which we refer has devolved upon the respective secretaries of the two first-named associations, Messrs. McKenzie and Tapp, and it is inspiring to note the enthusiasm of each of them for his chosen breed

OUTDOOR CULTURE OF THE GRAPE-VINE IN NEW ZEALAND.

S. F. ANDERSON, Vine and Wine Instructor.

INTRODUCTORY.

THE natural habit of the vine in a wild state is to climb, making use of trees, rocks, &c., to reach the light. The stems become a tangled mass like old ropes, many of the branches in the less favoured positions dying back, while others better placed reach upward. It will thus be seen that a vine actually prunes itself, and it is therefore no violation of the natural growth of the plant to prune and limit this growth, provided the foliage allowed is in proper balance with the roots. By artificial means the conditions of growth of the vines in the wild state can be improved on, the training being such that every leaf can be exposed to the light, and the roots nourished by cultivation and manures. Under these conditions the life of the vine may be prolonged for hundreds of years. In the work of Thudichum and Dupré, "Origin, Nature, and Use of Wine," is figured a vine of over a hundred years of age, trained and pruned on a system similar to that recommended in this article and generally favoured in New Zealand practice. The illustration is reproduced over page.

With the European class of vine winter pruning does not harm the plant, and is necessary for obtaining the fruit and keeping the vine within bounds. The way in which harm is done and the life of the plant shortened is by depriving it of an unfair amount of foliage during the growing season. This is done very often with the mistaken view that by reducing the foliage the vigour of the plant is expended on the fruit. The effect, on the contrary, is to starve the plant and to make the yield of fruit less. The method generally adopted in training the vine in New Zealand is that known as the double Guyot, with the fruiting-arms close to the ground.

The vines grown for winemaking are known as *Vitis vinifera*. The specific name *vinifera* means "wine-bearing," and comprises most of the kinds grown in Europe and other places for wine purposes. The varieties are very numerous. Some of the American varieties are also used in winemaking. These are very distinct from the *vinifera* class, and inferior for winemaking, owing to a peculiar black-currant or, as it is generally termed, "foxy" flavour

that pervades the whole family. The American class of vine is, moreover, deficient in the natural saccharine for winemaking. Owing, however, to their hardiness in resisting fungoid diseases, they are grown very largely in the north of New Zealand. They can also be used with some advantage in blending with sweet wines. The method of training the American vine differs in general from that for the European vine. They both require to be trained close to the ground, but from that point they differ. The method of growing American vines may, however, be applied to many of the European varieties, such as those that do best with the longer

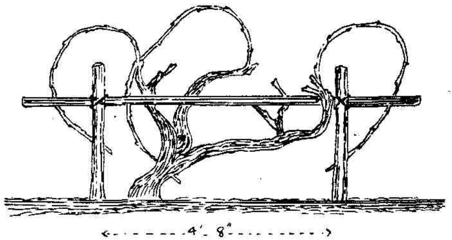


FIG. 1.—A HUNDRED-YEAR-OLD VINE, NEAR VERTEILLAC, FRANCE.
Trained and pruned on the double Guyot system.
[*After Thudichum and Dupré.*

methods of pruning. It is suited to the Black Hamburg, all the Pineaux, Golden Chasselas, &c. This method will be described and illustrated farther on.

VINE-GROWING AND METEOROLOGY.

In New Zealand the grape-vine will grow and ripen its fruit from the North Cape to Hawke's Bay, and in a few favoured spots as far south as Canterbury, the chief conditions required being freedom from frosts at the time of flowering and setting of the fruit, and a dry autumn. The selection of district should thus depend largely on the rainfall for the months of January, February, March, and April—more particularly March. Some seasons may run into April, but as a rule vines that do not fully ripen their fruit by the end of March should be rejected.

Comparisons have been made between the annual rainfall of our vine-growing districts and that of some of the best wine-producing countries of Europe, and generally with results favourable to this country, but this is not an infallible guide. The number of inches of rain that falls in a month may be confined to a few days, and

the remainder of the month be dry. It is continuously "dropping" weather with a low temperature that prevents the grape from acquiring the saccharine so necessary for making a good-keeping wine. The acidity is always high enough in our New Zealand wines.

It may be added that high hills draw the rain, especially so where heavily wooded. The rainfall of a district may vary considerably within a few miles, as will be seen by the following table compiled from information supplied by the Dominion Meteorologist, Mr. D. C. Bates, and amplified by a few returns gathered locally. It is therefore wise to keep well out from ranges running up to 1,000 ft. and over.

District.	Station.	Mean Annual Rainfall.	Mean Rainfall for Months of			
			Jan.	Feb.	March.	April.
		Inches.	Inches.	Inches.	Inches.	Inches.
Mangonui	Mangonui	54·52	3·78	3·26	4·31	4·58
Whangaroa	Kaitaia	51·43	3·29	2·45	3·87	3·39
Bay of Islands ..	Pakaraka	57·29	3·76	3·56	4·06	3·55
	Puhipuhi Plantation ..	71·57	4·61	4·45	7·53	5·09
Whangarei	Ruatangata	60·71	3·92	3·24	5·94	3·86
	Parua Bay	59·97	3·81	4·56	5·68	4·11
Kaipara	Bickerstaffe	50·33	3·48	2·67	4·80	3·38
	Helensville	45·54	2·83	2·19	3·72	3·98
Auckland	Auckland	42·85	2·52	2·85	2·99	3·20
	Onehunga	51·86	3·57	3·23	5·05	3·85
	Waiuku	57·24	4·13	3·41	4·05	4·31
Thames	Turua	46·23	3·20	2·99	3·95	4·24
Tauranga	Tauranga	50·59	4·62	3·56	3·77	4·55
	Athenree / Katikati	62·83	4·34	4·93	4·89	4·96
Waikato	Hamilton	51·07	3·88	2·6[illegible]	3·74	3·62
	Paemako	69·81	3·70	2·59	4·62	5·48
	Te Kauwhata Hort. Stn.	49·33	3·21	2·39	4·77	3·53
Rotorua	Rotorua	56·37	4·19	4·19	3·53	4·42
	Waiotapu	46·59	3·21	2·72	4·55	3·84
Taupo	Taupo	50·60	4·28	2·85	4·20	4·49
Taranaki	New Plymouth ..	59·35	4·16	3·97	3·70	4·30
	Eltham	53·43	3·65	3·06	5·04	4·66
	Taumatahi	61·12	4·76	3·87	4·04	5·23
Poverty Bay ..	Waihou	49·48	1·56	3·50	6·16	5·52
	Gisborne	49·39	2·72	3·88	5·03	4·86
Hawke's Bay ..	Wairoa	52·21	2·08	3·81	6·19	5·17
	Tutira Lake	55·03	2·65	4·66	6·62	5·54
	Napier	37·64	3·24	3·23	3·38	3·24
	Oruawharo, Takapau ..	42·92	2·03	3·38	4·42	3·22
	Greenmeadows.. ..	39·28	1·85	3·39	4·89	3·12
	Te Mata	92·30	[illegible]·17	2·89	5·81	6·49
Wanganui	Ruanui	48·40	3·29	2·88	3·06	4·54
	Wanganui	37·99	2·89	2·56	2·79	3·71
	Bull's..	37·71	3·20	2·26	2·89	3·17
Manawatu	Feilding	34·99	2·72	2·22	[illegible]·37	2·85
	Fitzherbert West ..	40·56	3·41	2·51	2·81	3·41
	Weraroa Expl. Farm ..	41·34	3·34	2·88	2·52	3·75
	Otaki..	38·46	2·86	2·51	2·75	3·22
Wellington	Pahautanui	44·82	2·95	2·82	3·07	3·37
	Opau, N. Makara ..	41·10	2·45	3·03	3·25	2·68
	Wellington	49·60	3·40	3·31	3·34	4·02

Those who desire to further study weather conditions in relation to the wine-making industry are referred to the publications "Meteorology in Relation to Farming," and "Meteorology of New Zealand," both by Mr. Bates, in which the subject is fully and ably set forth.

SELECTION OF SITE FOR A VINEYARD.

The site for a vineyard should be on elevated land, sloping to the north-east, north, or north-west, with a sufficiently easy grade to permit of its being worked as much as possible by horse-labour. Much steeper land can be used, but the cultivation must then be done by hand. Vines grow admirably on terraces. No doubt, as land becomes more valuable in those parts producing the best wine the time will come when the labour of working steep ground will not be thought more of than it is in other countries. Certain areas of flat land may, of course, be used where they form large terraces and have good natural drainage. If starting at the foot of sloping higher land, see that soakage or springs from the higher level are cut off by a deep drain. Avoid low-lying land of any kind, such as rich fertile flats, no matter how well they may grow other plants. It is in these situations, more especially where adjacent to swamps or slow-travelling streams, that fogs hang over longest and where fungoid diseases are most prevalent. Even where other conditions are favourable, rich soils should be avoided. The easiest-managed vineyards, producing the best wines, are those in situations where fertility has to be maintained by artificial means rather than from a natural richness of the soil. In short, the mechanical more than the chemical constituents of the soil enter largely in the conditions required for vine-growing.

It will be gathered that the quality of the soil is not so important a matter as the conditions to be obtained in elevated healthy places. It would be a difficult matter to point out a soil that would support vegetation at all where a vine could not be made to grow. Vines are now growing and producing excellent wines on gum lands in North Auckland, on clay soils that were covered by bush, on shingly limestone and sandy soils in Hawke's Bay, and pumice lands between Rotorua and Auckland. All these different soils show more or less effect on the wines produced, but this consists of some particular virtue rather than defect, and proves the generous nature of the plant with which we are now dealing. To quote from a West Australian handbook by Mr. A. Despeissis: "The choicer wines are produced in soils of a poorer description, especially on light sandy loams and ironstone gravel. In the case of wine it often happens that quantity is

adverse to quality. On rich alluvial, for instance, the must contains an excess of albuminous matter, which affects the keeping-quality of the wines, while bouquet is lessened, and a peculiar earthy flavour, disagreeable to the palate and the nose, is distinctly perceptible. A sandy soil generally gives a dry, thin wine, and if the season be moist the colour may be poor. The wines, however, produced on these soils are generally straight to the taste—that is to say, can be blended with most other wines, in order to dilute them, without changing their respective characters. A heavy clay soil, on the other hand, produces a full-bodied wine, heavy, rich in extract, and in some cases may impart to it an earthy taste. Between these two widely different soils there are other intermediate ones that partake more or less of the character of the one or the other, according to the respective proportion of their sandy or their clayey constituents. On limestone formations the wine will be delicate to the taste, with a fine brilliant colour, and a pleasant flavour which in the drier localities may be inclined to be fiery. Volcanic soils will produce vigorous dry wines."

SHELTER.

There are many places favourable for growing vines that require some break for the continuous heavy winds that sweep over them at times, especially during September and October. *Acacia decurrens* is one of the best trees for this purpose. The pine family, or most of them, grow too high and require a very wide headland, the vines within a chain being starved of nourishment. To prevent this a root-stop trench is in most cases advisable. Wherever cultivation is carried on near pines, or any other trees or hedges for that matter, their roots are attracted there and the yield of the vines will be reduced. An instance can be given where a strong hedge of African boxthorn (*Lycium horridum*) affected the vines for quite a chain from it. The shelter to be provided should be compact and low, with at least a 20 ft. headland (inside of root-stop) between the vines and the shelter.

The sides of the vineyard that require most protection are the south-east, south, south-west, and in some situations the west. It depends on the natural features of the site selected. If artificial shelter can be done without so much the better; a free circulation of air in the vineyard is most desirable—it is one of the best preventives of fungoid disease. Consistent, then, with fair protection from the worst winds, the vineyard requires an open and sunny position. The loss of half an hour or an hour's sun on the vines just after sunrise is not nearly so great as it would

be in the evening. In the case of a light frost, for instance, plants that are shaded from the rising sun may not be injured, because they are thawed slowly before the sun comes on them.

PREPARATION OF THE GROUND.

Seeing that the vine is a long-lived plant, and that when a vineyard is once established it can (with proper treatment) go on for a generation, it is necessary that the soil should be well prepared. Many of the Dalmatians or other so-called Austrians in North Auckland have gone to great trouble and expense in preparing their vineyards, trenching the ground three spits deep by hand. They will no doubt reap the benefit of their thorough work. Where the subsoil is a heavy clay, however, it is some years before it becomes sufficiently aerated and mellowed down to be a good growing-medium. Digging from 18 in. to 24 in. would be sufficient—that is, when done by hand. Most of the vineyards have been prepared by subsoiling with the plough. As a rule this has been done in a very indifferent manner, and the soil is not broken up more than 9 in. or 10 in. It is a question of horse-power. The first plough, to get down 7 in., should have three or four horses, and the subsoiler never less than four horses. Then the depth may reach 14 in. This is one of those jobs that it is not wise to let by contract. With two good teams, one following the other in the same furrow, and suitable ploughs, really good work can be done. This method leaves the subsoil down below and yet thoroughly breaks it up. There is no question about the superiority of spade-work over the plough in preparing a vineyard, and where it can be done it will pay the grower in the end.

In places where there is a hard-pan beneath the top soil a hole from 2 ft. to 3 ft. deep and on the slant should be made with a crow-bar or a 2 in. auger. The bottom of the hole should come as near as possible directly under where the vine is to be planted. Half a plug of gelignite is then inserted, with fuse and cap attached. The charge is rammed in tight and exploded. The explosion causes the hard-pan to crack for several feet around, thus allowing the roots to penetrate to the subsoil below. The object of making the hole on the slant is that the soil thus offers more resistance to the explosive.

This method of breaking up the subsoil instead of using the subsoil plough is carried out extensively in Australia, and has been found to be more thorough and more beneficial to the growth of the vines. The usual way there is to make the holes from

20 ft. to 24 ft. apart, 2 ft. 6 in. deep, always in a slanting direction. Then one to three plugs of gelignite are used, according to the nature of the hard-pan. After an explosion of three plugs of gelignite in a particularly hard and stiff soil, cracks have been traced for a distance of 33 ft.

After the ground has been thoroughly subsoiled in the manner described, it is ploughed, cultivated, and harrowed, and is then ready for marking out.

SELECTION OF VINES FOR WINEMAKING.

In giving the list of wine-grape vines that follows it is not intended to lay down any hard-and-fast lines in respect to not trying other varieties that may be suitable to a particular locality. The grapes described, however, are the best for wine-making in New Zealand, having now been well tried for many years. *It may be advisable, however, to state that in some cases* men experienced in viticulture in other countries have set about the establishment of vineyards in New Zealand with such preconceived ideas of what should be grown here that not until failure *convinced them did they listen to the earlier growers* of the kinds that had by experience been proved suitable. For instance, those vines that produce the famous sweet wines of the Cape, California, and Australia are quite unsuitable to the New Zealand climate. It may be stated right out that a natural sweet wine cannot be made in our temperate climate. The long dry autumn where the grapes can hang without injury until partially desiccated is not met with in our climate. In suitable localities the vines given in the list will ripen their fruit perfectly, and that is what is required for making good wine. Perfectly ripened grapes contain all the elements for making a good-keeping, less intoxicating, and fine-coloured wine. With properly ripened grapes and clean conditions wine is much easier to make than with grapes not ripe and to which sugar is added to make up a deficiency of the natural saccharine. Taking the dark grapes first—

Pineau Meunier.—The chief stock vine for growing in all parts of New Zealand and the mainstay of the winemaker is the Pineau Meunier. Fully two-thirds of the vines grown for winemaking in the Dominion are of this variety. It is the hardiest of all our wine-producing grapes. It is the most regular, consistent cropper, contains the largest amount of saccharine, and fully bears out, wherever grown, the high character claimed for it by the great French authority, Dr. Jules Guyot. It ripens well within our grape season (March). Judging by reports from other countries,

including Australia, it bears a heavier crop in New Zealand than in those countries. Although a black grape, a fine white wine can be made from it by drawing off the must from the crusher before colour is imparted to it by the skins. It is one of the champagne grapes. It is subject to black-spot in the northern vineyards and mildew in Hawke's Bay. Grown on the double Guyot system, it produces on an average about 400 gallons of wine to the acre.

Pineau Noir.—This is a similar grape to the Pineau Meunier, is nearly as hardy, makes rather a better wine, richer in colour, equal in density and saccharine, but is not such a certain and heavy bearer. The yield is about 300 gallons to the acre. The variety does best in Hawke's Bay. Although the produce of these two Pineaux enter largely into wine sold as claret, they are really a Burgundy and good enough to stand by themselves, their alcoholic strength being rather high for a claret when perfectly ripened. The chief drawback to both varieties is their tightly packed bunches, which in wet seasons are liable to rot in the centre.

Cabernet Sauvignon.—This is the highest type of black grape grown. It is the choicest red-wine grape of France. It is this grape that gives the bouquet and flavour to claret, and it should form at least one-third to one-half of wine sold under that name. A good claret should possess a fine bouquet, great aroma, and plenty of character, without being high in alcohol, and should not contain more than 10 per cent. of absolute alcohol. The Cabernet Sauvignon does well in nearly all parts of the North Island where grapes are grown. It bears a heavier crop in New Zealand than in Australia. Owing to its berries having a thick skin and the bunches being of an open nature, they will stand a wet season better than the Pineaux. It is rather more subject to black-spot and mildew than the Pineaux, but quite under control when using Bordeaux mixture for the former and sulphur for the latter trouble. It must be grown on well-drained elevated land. It has proved to be a regular and consistent bearer, and yields about 300 gallons to the acre. It is not a strong grower, and the fruiting-rods cannot always be replaced annually, so that the old rod has to be spur- or cordon-pruned, as will be described later.

Shiraz, or Hermitage.—This is a fine wine-producer. It is the strongest grower of the dark-wine grapes, and is grown in nearly all our vineyards. It is suitable for making a sweet or dry wine, and should form one of the constituents of claret. It is a good bearer, and, having open loose bunches with fairly thick-skinned

berries, they do not hold the wet. The trouble with this variety has been an unevenness in ripening its fruit. This defect occurs when grown on rich land; the poorest part of the vineyard should therefore be selected for placing the Shiraz. It is more suitable for the gum lands of the North than for Hawke's Bay. Where this unevenness of ripening can be overcome it is a valuable wine-grape, the yield being from 400 to 600 gallons per acre. The highest amount of saccharine obtained in Hawke's Bay with this grape has been 20 by the Guyot saccharometer. It rarely reaches this, however. Although paradoxical to the previous remarks regarding avoidance of rich soils, this unevenness of ripening can be mitigated by the judicious use of a stimulating artificial fertilizer—nitrate of soda for preference. This should be applied from ten to sixteen days after the fruit has set, at the rate of about 168 lb. to the acre.

Cabernet Franc.—This is one of the best wine-grapes. It is a good bearer, has an open bunch, and resists decay in wet seasons better than the Pinots. This variety succeeds in all parts of the North, and is deserving of more attention from the winemaker.

Malbec.—This is a fine grape. It is a good bearer, resists disease (being hardly affected by Oidium), has a fine colour, and is one of the constituents of claret. It does not obtain a high percentage of alcohol, so that a wine made from it alone is more subject to changes of temperature. Its special virtues are freedom from disease, perfect ripening, not too close in the bunch, and the fine colour it imparts to other wines. It does better in Hawke's Bay than in the North.

The foregoing six varieties of vines produce the best dark grapes for winemaking in those parts of the Dominion that are suitable for viticulture. They have all been well tried, and can be relied on in any average season to give fair returns.

Teinturier, or Tinto.—This grape has a deep-coloured juice, and is valuable for adding to others where a deeper colour is required. Its alcoholic strength is very low, even when well ripened, and the wine requires to be fortified to keep it. In itself it is useless for making any definite type of wine.

The white-wine grapes that have given the best results are as follows:—

Pedro Ximenes.—This is a fine type of the sherry grape, although requiring a hotter and drier climate than can be obtained in any part of New Zealand to develop its qualities for the making of sherry. It does well in Hawke's Bay and in some parts of the North. It runs from 17 to 20 per cent. in saccharine by the Guyot

saccharometer, and makes a delicately flavoured hock when well ripened. If not well ripened it runs very high in acid. Although not high in alcohol the wine keeps well.

Riesling.—This grape yields the choice hock wines of Germany. It is extensively cultivated in Australia for hock. It does well in Hawke's Bay and in places in the North.

Pineau Chardonay.—This white grape differs a good deal in appearance from the three other Pineaux (Meunier, Noir, and Gris). It is a strong grower, has larger and more open bunches, and ripens later, being one of the latest varieties. It is the grape from which the Chablis wine is made. When grown on the *en chainire* system of training is an enormous bearer. Although late in ripening, it is one that can be depended on in most years for a crop.

Verdeilho.—This is another white grape that does well in favourable localities. It is known as the Madeira grape. It has not been grown so much as the foregoing varieties. Verdeilho makes a fine dry wine.

ineau Gris.—This is one of the champagne grapes, and one of the best to grow for white wine. It goes very high in saccharine, and makes a fine keeping wine. It will become in time the leading grape for the production of a high-class wine. The variety ripens early, is a sure cropper, and does well in all the wine districts.

Very fine light wines can be made from the four varieties of grapes just described—that is, light dry (not sweet) wines. Unfortunately for the winemaker these do not at present meet the public taste; but in the writer's opinion, from a health and temperance point of view, they will some day become the drink of the country, especially during the summer months. They are not only the most wholesome, but much the cheapest to make. They do not require years to mature, being fit for the market in two years' time from the making. The vines are heavy bearers, yielding from 400 to 600 gallons to the acre, and ought to reach the consumer at 5s. per gallon in bulk. Until, however, the drinking habits of the public become educated as to what is most health-giving and satisfying to the taste, it cannot be recommended to plant a large area of white-wine grapes.

PHYLLOXERA-RESISTANT STOCKS.

Considerable experimental work has been carried out by the Department of Agriculture at the Te Kauwhata (Waerenga) and Arataki Horticultural Stations in testing a large number of resistant vine-stocks. It will be sufficient for the purpose of this article

to state that the number has been narrowed down to the three best kinds — namely, Mourvedre - Rupestris, Riparia - Rupestris, and Du Lot. The first-named of these three is perhaps the most popular. Good results, however, are being obtained from the other two. As the *Phylloxera vastatrix* still exists in the northern parts of the North Island, and there is always a danger from getting it into a vineyard, all vines should be grafted on one or other of the above - named stocks. Viticulturists are deeply indebted to the skill and ingenuity of the French viticultural professors in perfecting a vine-stock that has overcome the calamitous disease that was devastating the vineyards of the world. The resistant stocks evolved by them are the result of an immense amount of experimental work in the selection and crossing of different kinds of the wild American vine. To obtain the present useful stock the wild vine, with wood no thicker than its relative the Virginian creeper, has been crossed with other resistant varieties of a stouter wood but with less resistant qualities. In fact, the present resistant stocks are all combinations of this nature. Some of the resistant qualities have had to be sacrificed to obtain a wood sufficiently stout on which to graft the scions of the European varieties, while still retaining sufficient resistance to be useful.

LAYING OUT AND PLANTING THE VINEYARD.

In some works on viticulture it has been suggested that the distance apart the vines are planted should be regulated by the quality of the soil—planting closer on poor soil than on good. As all the vines in New Zealand, with the exception of the American varieties and a few that may be grown in broken country that would not permit of it, are grown on espalier trellises, horse-labour must be used for economy of working, and less than 8 ft. from row to row would not suffice for taking a cart through and using the best modern cultivators. Then, as to the distance from plant to plant, as the training of the vine here is generally on the double Guyot system, the fruiting-rods (extending 4 ft. each way from the stem) require 8 ft. from vine to vine, therefore 8 ft. by 8 ft. is the best distance. The headlands should be 20 ft. wide, to allow of a team pulling out of one row and turning into another. Where the vines are planted this distance and trained on espalier trellises it does not matter whether they are planted on the square or alternate. The rows should run north and south if the vineyard is on fairly level land, but on undulating country the contour of the land may have to be followed. If regularity is to be maintained, this is not so simple a matter. For instance, in planting the face of a sloping round hill the rows of vines should

follow round the face of the slope, and the cultivation should cross the slope; otherwise the surface soil would be worked down hill, in time uncovering the roots of the vines at the summit and down the slope. Here is seen the difference between planting a vineyard where the vines are grown on espalier trellis and the planting of an orchard. In the case of the vineyard the lines have only to be correct one way, so as to suit the horse-worked implements, the exact placing of the vines in the row not being

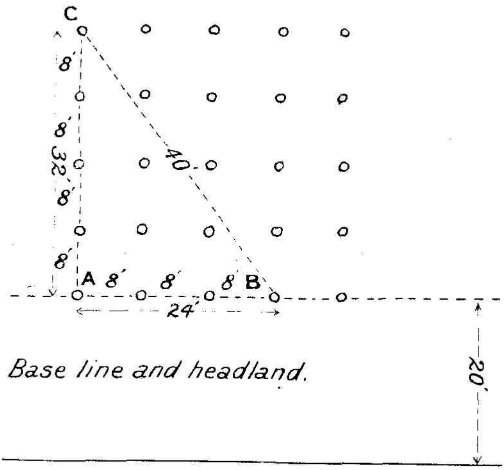


FIG 2 PLANTING THE VINEYARD.—HOW TO OBTAIN A RIGHT ANGLE.
[Original.

such a matter of importance so long as the rows are perfectly straight. Some brief directions how to start will now be given:—

On Level Land.—The starting-point must be from a base-line. This may be a road or boundary fence, or if neither of these is available it may be decided on in some other way—by a pocket-compass, for instance.

In the plan the base-line is a headland, and runs east and west, as where it is a matter of choice north and south should be selected for running the espalier fences. Assuming that the vines

are going to be planted 8 ft. apart, we put in the first stake at A, then measure off as near as possible at right angles with the base-line four 8 ft. spaces, and put in the stake C. Measure three 8 ft. spaces along the base-line, and put in a stake at B. Then measure exactly 40 ft. from B to C, shifting the stake at C one way or the other to meet the measurement from B. The line A to C is then an exact right angle to the line A and B. Having now a base-line and a right angle to that line, the line AC can be extended to the end of the field in 8 ft. spaces, and the staking worked across the field from them as shown on plan. In marking off the angle and for general measuring-work a light flexible wire with a ring at each end for pulling on will be found handy. The espalier trellises need not be erected for two years after planting out the vines, and if the vines are carefully placed it will permit of their being horse-hoed the two ways, until the espaliers are put up.

On Sloping Ground.—If the slope is not greater than 1 ft. in 5 ft., the lines of vines may run down the slope. Horses can plough up a face not steeper than this. In starting to lay out a vineyard on land having a slope, commence in the centre at the top and run a line from top to bottom, then work right and left from that line. The vines can be planted every 8 ft. of surface measurement—that is, no allowance need be made for the slope of the land. The right angle for starting the first line will be taken from the top headland. The length of the espalier trellises should not exceed 5 chains, then a road. Long strains of fences are not convenient generally, although this matter is best left to suit the cartage of grapes, manure, prunings, &c.

If the site of the vineyard is one occupying the northern face of a round hill with considerable slope the arrangement would be quite different. Where the slope of the land is greater than 1 in 5 it is obvious that all cultivation will hurry the soil down the hill; but between a slope of 1 in 5 and one much steeper (say, 1 in 3) the face might still be worked part by horse and the rest by hand labour. To do this the vine-rows would have to be round and across the face of the hill. Any site selected with a greater inclination than this would require terracing to hold the cultivated soil. In the case of all steep faces drains would have to be provided to catch and convey heavy falls of rain, otherwise the rain would cut into and carry away a great deal of the loose soil. In broken and steep faces vines can be grown in pockets, or places just dug out to hold them, and trained *en chaintre.*

The plan in Fig. 3 is given in order to suggest some method of laying out a vineyard. It shows 10 acres laid out with a view of working the area to the greatest advantage. It is divided into eight plots of about 12½ square chains, all within easy access to the press-house and cellar, with headlands measuring 20 ft., dividing-

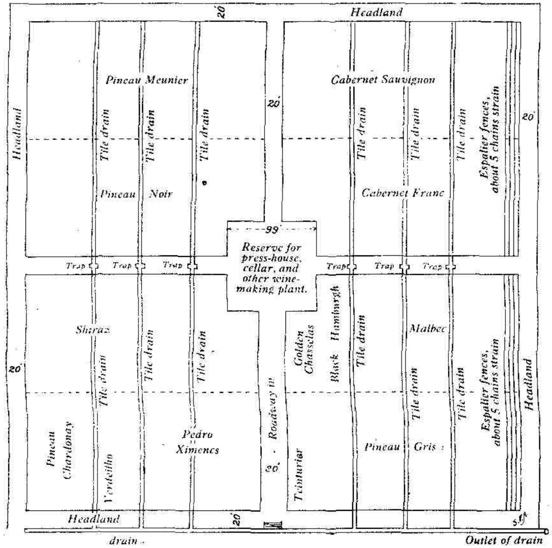


FIG. 3. SUGGESTED LAY-OUT OF A 10-ACRE VINEYARD.

NOTE.--The espalier fences, as figured on right, to be repeated throughout vineyard.

[Original.

roads 16 ft., and centre road from gate to buildings 30 ft. Dwelling, stables, and shelter-trees are not provided for in the area.

If the land has been prepared as suggested in the section on "Preparation of the Ground," it should be left from four to eight months to aerate and mellow down. If it has been scrub land, then eight months—the longer the better. To break up land of this nature thoroughly the work would probably have to be done in spring, when it is still soft from the winter rains. In the

summer and autumn there is small chance of getting deep enough to make a good job. This is the best preparation the land can have for vines, or, for that matter, any other horticultural purpose. The writer does not advocate heavy dressing of lime to mellow down this class of soil—at all events, at this stage. Long exposure to the weather is most effectual in this respect, and what little humus there is in this description of soil is retained for the benefit of the plants.

It is assumed for the purpose of this article that a 10-acre vineyard has been decided upon. The land has been prepared, and the selection of vines has now to be made. The present demand is for claret, sweet dark, Burgundy, sweet white, and hock. A small lot for European table grapes is provided. The eight plots on the plan might be planted as follows: No. 1, Pineau Meunier; No. 2, Cabernet Sauvignon; No. 3, Pineau Noir; No. 4, Cabernet Franc; No. 5, Shiraz; No. 6, divided in four parts—one Golden Chasselas, one Black Hamburg, and two Malbec; No. 7, divided into three parts—one Pineau Chardonay, one Verdeilho, and one Pedro Ximenes; No. 8, divided in four parts—one Teinturier (Tinto), and three Pineau Gris. The above varieties of grapevines, with the proportions of each, are merely suggested, and might require some adjusting to suit a particular district. They are, however, all good kinds and give fair returns. The Teinturier is grown for its rich dark colour, and for its usefulness in blending with wines deficient in that respect.

(To be continued.)

SMOTHERING OUT SORREL AT RUAKURA.

SORREL spreads readily over the swamp areas at Ruakura, and on this land ryecorn sown in spring and Western Wolths and Italian rye-grass sown in autumn are the crops employed to smother out the weed. Barley, peas, or vetches will not thrive on the swamp land. Last autumn 13 acres of badly infested sorrel land was sown down in Western Wolths rye-grass, the treatment being as follows: 5th April, ploughed 6 in. deep; 18th April, Cambridge-rolled; 19th April, disked, harrowed, rolled; 20th April, broadcasted 20 lb. Western Wolths per acre, together with 1 cwt. Ephos phosphate, 1 cwt. Seychelles guano, and 1 cwt. basic superphosphate. A very fine take of rye-grass resulted. From August to November the field was stocked with heifers and cows at intervals, then closed, and on 17th January, 1917, the crop was threshed for seed. At the present time there is scarcely any sorrel to be found on the area. This season 28 acres of swamp land is to be treated by the same method, but laid down one month earlier.—*A. W. Green, Manager, Ruakura Experimental Farm.*

EUCALYPTS FOR SETTLERS.

FURTHER SPECIES AND WHERE TO PLANT THEM.

J. H. SIMMONDS, Auckland.

(Concluded.)

CLIMATIC CONDITIONS.

THE main determining factor in the limits within which a species of Eucalyptus can be profitably grown is temperature. Our rainfall is in all but a few localities sufficient; but the very low temperatures that recur in the southern portions of the Dominion and on our high inland plateaux present barrier-lines beyond which the tender species, even if they can survive at all, soon cease to be sufficiently vigorous for profitable cultivation. It is, however, not possible to say exactly how many degrees of frost any particular species can endure, for the reason that the same degree of frost is not always equally injurious to any given plant. Much depends upon the duration of the low temperature and upon the season of the year at which it occurs. Summer frosts are everywhere regarded as more destructive to tender vegetation than those that occur in winter. Sometimes the effect of a very severe frost is modified by the presence of vapour in the atmosphere or of water in the soil, or by movement of the air itself. When so many valuable trees were damaged or killed by frost in Canterbury in 1889 and again in 1903 it was found that the trees on the dry ground where they had been weakened by drought suffered most, while those that were near the water-races and rivers in many instances almost escaped injury. Whether moisture in the air, or the unfrozen moving water in the soil, or the superior vitality of the trees made the difference we do not know. In this connection we must remember that climatic conditions are in many cases modified by the local contour of the land. Warm and genial areas may from this cause be found in sheltered bays near sea-level, or amongst low hills, much farther south than we should otherwise expect to find them. Thus Mr. G. R. Beamish, at "Whanawhana," among the foothills of the Hastings basin, Hawke's Bay, enjoys a climate more congenial to tender vegetation than we can find on the Auckland Isthmus; while Mr. Orton Bradley, at

Charteris Bay, near Lyttelton, and other settlers in the sheltered valleys of Banks Peninsula, can grow trees that would not live through a single season on the open Canterbury Plains.

We have further to remember that frost-resistance may vary greatly amongst plants that are regarded as botanically identical in species. Many of the eucalypts have a very wide natural distribution, and are called upon to endure much harder climatic conditions in some localities than in others. The source whence we derive our seed thus becomes a very important factor in frost-hardiness. *E. obliqua*, for example, from south Tasmanian uplands may be a much more frost-resistant tree than *E. obliqua* from east Australian lowlands; and the same remark applies to all

BELT OF EUCALYPTUS GLOBULUS.—BROWN'S DISTRICT, SOUTHLAND.

The exceptional vigour of the trees in this case is due to favourable local contour of the land.

species distributed by nature over a wide geographical zone, and at various altitudes. Eucalypts can endure strong inland winds, but most of the species suffer at the tender-growing tips when exposed to persistent saline breezes from the sea. In all exposed sea-coast situations they should therefore be protected by a screen of hardy pines.

SOIL.

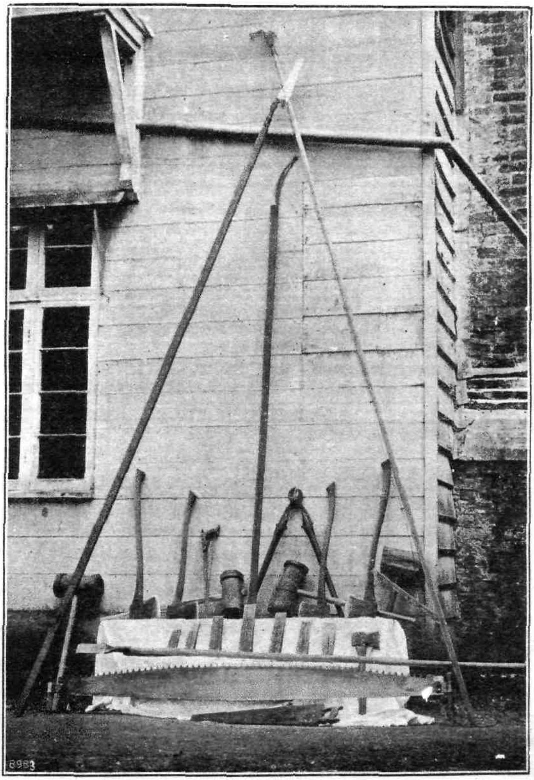
Most of the species can grow on almost any kind of land provided the subsoil is sufficiently free to allow the roots to descend to a great depth and continuously find moisture without excessive wetness. A very shallow soil lying on pure shingle causes shallow rooting, and results in the trees being easily blown down. This

condition is seen in certain parts of Canterbury, where many fine specimens of both pines and eucalypts will sometimes be uprooted in a single gale. But if there is soil mixed with the shingle or mixed with broken rock, the roots will go down and the trees be firmly held. A hard impervious stratum or pan a little below the surface is detrimental, as it not only causes shallow rooting, but subjects the roots in the rainy season to excessive wetness. There are probably no better lands in the world for growing pines and eucalypts than what are known as our pumice lands. These pumiceous deposits admit of very deep rooting, and they also in all seasons retain sufficient moisture to keep the trees growing without ever being oversaturated or swampy. The poorest of the pumice lands will grow suitably selected trees, and grow them rapidly to a large size.

The writer is strongly of opinion that sowing the seed where the trees are to grow is the best method for most people to follow. Many plantations have been established in this way in New Zealand; and any failures that have been reported have been due either to a bad condition of the soil or to faulty seed. Virgin soil or newly worked grass land will give the best results; land that has been impoverished by cropping the worst. Mr. Thomas Chapman, of "Mount Palm," Canterbury, tells of a case in which he sowed Eucalyptus-seed on a patch of land part of which had been cropped and part worked out of virgin tussock, with the result that there was a splendid take on the virgin soil and only a very weak take alongside on the land that had been cropped. Other similar cases could be cited. Scores of instances could also be mentioned in which eucalypts have propagated themselves on virgin soils in this country without any cultivation at all; and if nature's hint were heeded many settlers would soon have rising crops of valuable trees without the cost of ploughing and working. If the scrub is very light, nothing need be done but sow the seed; if it is heavy, a good burn will make the necessary preparation. September–November and February–April are the seasons for sowing Eucalyptus-seed. Light harrowing is desirable, but not always necessary.

GENERAL RULE FOR SELECTION.

The general rule to be acted upon by each intending planter manifestly is to select the best trees that his particular climatic conditions and soil will permit him to grow. The wise man will not fight against nature, but will try to find out the limits of her permission and act accordingly. In a warm and sheltered situation not much above sea-level, with a deep and well-drained soil, the choice of species will be large; on a frosty flat or cold exposed



TOOLS FOR THE PLANTATION.

upland, with the soil-conditions less favourable, the choice will be very much restricted; but in each situation, with a suitable selection, the land may be soon clothed with beautiful and useful trees. In ascertaining what nature will permit us to do in any given circumstances we shall, if we are wise, use the experience of others as far as it will serve us; but we must also use our own judgment and contribute our own share to the work of experiment.

A SECOND CROP FROM STUMPS.

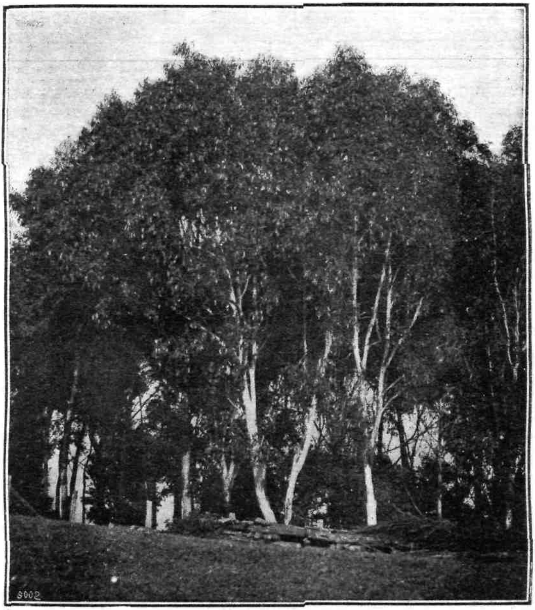
Most of the eucalypts will sprout and grow again from the stumps after they are cut down, and in this way a second crop can be obtained in less time than was required for the growth of the first. To ensure prompt and vigorous sprouting the felling should be done just before an active growing season. The stump should be cut with a clean surface, dipping one way so that the rain will not lie on it and cause decay. Soon after the sprouts are fairly established their number should be reduced to three or four of the strongest. Others may be removed later, after they are large enough to be turned to account.

CONVERSION INTO POSTS AND BUILDING-TIMBER.

For the sake of those who already have Eucalyptus-trees large enough for use it may be well to say something about methods of treatment in converting the living tree into either fencing-posts or building-timber. It is an established principle in scientific forestry that timber-trees shall be cut down when their vital forces are least active, or, as the foresters put it, when the sap is down. Deciduous trees will be in the dormant condition as soon as their leaves have completely fallen in late autumn, and thence until their life-forces begin to move again for the next spring's growth. For evergreen trees the felling season is by no means so easily determined. Close observation shows that generally in this country eucalypts continue to grow more or less all the year round. In some instances they even make more growth during the winter half of the year than during the summer half. The seasons when they are least active are late summer (January, February) and midwinter (June, July). If we wish the stumps to sprout again, we have to consider a double problem—viz., the best season for felling the timber, and a safe season for ensuring a good crop of sprouts from the stumps. If autumn sprouting is satisfactory, then the trees may be cut down in January and February; but if it is found that good sprouts

will come only in spring, then the felling must take place from June to August.

Where powerful sawing machinery is available it may be best and cheapest to saw out fencing-posts; but in the absence of



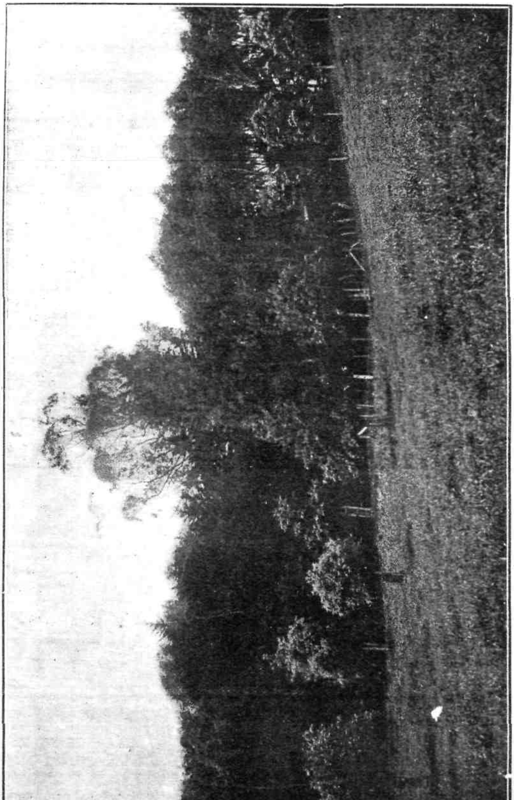
EUCALYPTUS CORIACEA.

The two trees with white bark and spreading branches in centre of picture are specimens of this very hardy species (described in last month's *Journal*), planted at Wesley Training College in 1904.

such machinery the largest Eucalyptus boles can be converted into ordinary-length posts by splitting if the workmen know their business and are furnished with the necessary appliances — viz., crosscut saw, axes, mauls, full set of good wedges, large-sized

auger, a hardwood rod for tamping, and a sufficient amount of explosive and fuse. The explosive should be blasting-powder, which, if centrally placed and tightly plugged with dry clay, so as to equally divide the resistance, will rend the log into two parts with a clean rift. Other explosives are liable to shatter the log and thus waste a considerable percentage of the timber.

The question of converting eucalypts into satisfactory boards and scantling is much more difficult, even if we have the required machinery, for here we have to contend with the tendency of many species to crack and warp in drying or even under the saw. Some people recommend ring-barking the trees a year or two before they are to be felled, but this would kill the trees right out and prevent the sprouting of the stumps. Others suggest felling the trees and allowing them to lie for a year before they are cut into logs and milled. The objection to this is the extra labour entailed by the drying and hardening of both boles and tops. The usual practice is to fell the living tree, carry the logs as quickly as possible from the stump to the saw-bench, and then put them through without unnecessary delay. If delay is unavoidable the ends of the log should be covered up with earth or sawdust to prevent cracking. In the process of sawing, the man at the bench will need to exercise skill and judgment. He will find that if a small-sized log is cut down the middle the sap and heart will immediately contract or expand unequally and draw each half into a curve. This very awkward result can be avoided by first running off the sap on two opposite sides and then on the other two opposite sides, so as to convert the log into a squared balk. When this has been done the heart-wood can be sawn into planks or scantling without further difficulty. But cracking at the ends will still go on indefinitely unless something is done to prevent it. Two methods are possible: The planks or scantlings may be closely stacked and the ends heavily covered with sawdust until they gradually season and dry, which under these conditions will take a long time; or the planks and scantlings may be sorted into sizes and lengths and stacked with thin battens between. If this latter method is resorted to the intermediate battens should be narrow and the end ones very wide. If the timbers are of equal length and carefully laid with end battens 6 in. to 9 in. wide, and the stack then shaded with slabs, cracking will be reduced to an almost negligible amount and warping also prevented. Obviously the seasoning process could be carried out much more perfectly under the cover of a large shed than in the open.



EUCALYPTS IN COMBINATION WITH OTHER TREES.—WESLEY TRAINING COLLEGE, AUCKLAND.

In the native homes of the eucalypts, Australia and Tasmania, enormous quantities of these trees are annually converted into boards and scantlings for all kinds of purposes. In Tasmania alone there are about a hundred sawing plants engaged chiefly in converting Eucalyptus timber into the sizes and shapes necessary for general construction and technical work. From these facts we may safely infer that there are ways and means for overcoming all moods and tenses of the seasoning problem. In Canterbury the travelling sawmill is already an established institution, and it will become so in every other district as soon as there is sufficient demand for its services. When a settler's trees are ready such a mill will be able at a single visit to cut his firewood and saw out his boards and scantlings for a year's needs ahead.

THE GREAT PROSPECTIVE VALUE OF TREES.

I am not asking farmers to restrict their planting to eucalypts. There are many other trees that can give pleasure and help the annual balance-sheet. Oaks will supply food for poultry and pigs; nuts may be grown for the market; pines will furnish soft, light woods for fruit-cases, butter-boxes, and internal fittings for houses. Already the farmer who has neglected to plant is often glad to go and beg or buy a tree or two from his more provident and enterprising neighbour who in due time gave up a reasonable percentage of his land to the production of timber. With the world's supply growing steadily less and prices everywhere rising, the contrast between those who have and those who have not planted will become increasingly acute.

The especial purpose of these articles is to urge the farmer to plant for his own consumption; but if the consensus of experts on this great economic question is to be taken as a prophecy, we may safely regard well-grown trees as prospectively a saleable asset. Calculations as to the value of the timber that may be grown on a given area in a given number of years may be misleading, but we can scarcely be misled by a general and persistent trend of economic conditions. A close study of the timber problem seems to warrant the prediction that in twenty-five years the sawmiller will be hunting round in all directions for material to keep his machinery going, and offering for trees on the stump prices that will make many a man wish he had planted some reasonable area of forest instead of keeping all his land in open grass.

It is the attention given to all details that makes poultry-keeping pay, not doing one thing well and neglecting the other.

ESTUARIAL LANDS OF THE NORTH ISLAND.

AND THE GOSPEL OF LIME.

D. M. ROSS, Fields Supervisor, Hamilton.

A GREAT number of people have an idea that "swamp" means a more or less unfathomable peat bog, to be avoided where quick returns in farming are desired. To the writer's mind, however, the time is coming when most of our attention in this country as regards settlement will be directed to the swamp lands. Speaking generally, the last of the open tussock and fern country is being settled, while most of the bush lands, which cannot be highly developed for years, are now only available in the backblocks. But there remain in the North the great estuarial areas, capable of the highest development, and to which we must direct the activities of producers, as those still unproductive or only partially productive represent immense tracts.

These lands include the old and now almost non-existent swamp of the Ngaruroro and Tutaekuri River systems in Hawke's Bay; the magnificent Rangitaiki Swamp, which promises to become a miniature Denmark, with mighty climatic advantages over that country; the great Hauraki Plains, with their continuation in the Piako Swamp; the Waikato River, with its various offshoots; and, of a less extensive area, the fine raupo and flax swamp of Te Kawa, inland from Hamilton; and the Rukuhia Swamp, which runs from Ohaupo to Frankton. The Rukuhia was undoubtedly connected with Piako Swamp; the Kawa is on a higher level, and is really an inland swamp unconnected with the seaboard. There are also great areas of swamp land north of Auckland, but I am not sufficiently intimate with them to venture a description here.

The Hawke's Bay Province has an interesting geol gical history; the whole area of it appears to have been elevated to considerable heights, as is shown by inland shells, evidently of the marine genera, embedded in old mud of the sea-bottom. Also I have seen a fossil shark's tooth taken from a hilltop over Kuripapango, towards inland Patea. Originally (if the term may be geologically applied), what are now the plains and valleys and swamps of the east coast were bays and inlets running a considerable distance

between the foothills of the old giant inland mountains. The Heretaunga Plain is a fine example of humus and pumiceous deposit, with other ingredients so finely proportioned and intermixed as to produce almost the greatest possible natural fertility. To understand this thoroughly it is necessary to remember that hills surrounding this plain are of rich limestone formation. In proof of the extraordinary fertility of this complete soil, containing nitrates, phosphates, sulphates, carbonates and chlorides, lime, potash, magnesia, iron, soda, and silica, it may be instanced how rye-grass is harvested year after year from the same paddocks, producing the finest seed of the Dominion.

The processes of reclamation through the slow ages are very evident. At the time of Captain Cook's visit to what is now Gisborne, Cape Kidnappers, and Hawke's Bay the Napier Hill was an island which one could sail round in a craft of considerable draught. It is still, I understand, called Scinde Island. In those days, then, the sea ran well up towards Greenmeadows, and in flood-time the whole country between the meadows and the sea would be one sheet of water, heavily charged with silt and finely ground pumice from the high ranges at the sources of the two great rivers Ngaruroro and Tutaekuri, which now converge as they near the sea.

The whole inland area of which Taupo is the centre has been in the crucible. A great volcanic cone was firmly though fearfully based where now rolls the magnificent inland sea, at one time said to be unfathomable—Taupo Moana. At Western Bay the old crater-walls rise from the bed of the lake, a thousand feet below, to the crest of the Waihaha crags, hundreds of feet above the lake-surface. The giant volcano was the great soil-maker, and in the work of grinding down the rocks and ejecting them in lava-flows and sun-darkening pumice-showers he was assisted by his satellites Ruapehu and Tongariro, who, as is the way with human progeny, carried on the work long after the old progenitor was cold and dead. The work of distribution was taken up by the rivers previously named and the Mohaka, flowing to the east; by the Rangitikei and others rivers that take their rise in the Kaimanawas, and by that finest of all New Zealand rivers, the Waikato, each emptying itself on the west coast. Evidences of upheaval are noticeable in many places. There are great shell-beds over Moawhango, and I have seen embedded in soft rock on the top of the Maungaharuru Range a round waterworn stone identical with those that are rolled into the sea from the Ngaruroro near Clive, and carried northward towards Mohaka by the drift of the tide.

At this time perpetual war was waged between the waters. The rivers coming from great heights ran furiously, cutting deep into the rock, as may be seen, and shooting their stones and silt far beyond the present mouths. Coming, as water will, nearer every day to the fulfilment of the eternal law, the waters of the earth and of the sea drew nearer to a level, and the long range of the rivers gradually shortened. Nearer and nearer the land the river deposits were laid, and in great thundering the unbitted ocean combers began to throw up barriers along the shore in the form of spits, sand-banks, and dunes. Rivers wandered through the plains in a seemingly indefinite way, but all the time as if with a fixed and shrewd purpose. At times they broke through the sand barriers, but these were quickly repaired by the ocean. Sand bars muzzled the disgorging rivers and tides checked their velocity. All this time the barriers were rising. During flood-time the waters were held back over the original land-surfaces and forced to let fall their rich deposits of pumice from the far volcanoes, clay from the crumbling river-banks, humus from the fine untrodden forests of the foothills, and carbonate of lime from the faces where thousands upon thousands of sheep are now pastured.

This same process of reclamation set in operation by a Napier engineer, Mr. C. Kennedy, has produced what is now a suburb of Napier. He simply dammed the flood-waters back and appropriated their silt.

Inland, within the memory of man, Hawke's Bay was richly clothed in fern and scrub, mountain-flax, koromiko, kowhai, fine timber forests, and vast areas of magnificent beech bush that billowed away to the tops of the highest ranges. Mr. G. P. Donnelly informed me that when he first saw Mangaohane Station, on the Rangitikei River, it was covered with koromiko and mountain-flax. Now little of either is to be seen. The inland country has been cruelly denuded of vegetation. The blight of the match has fallen on the Kaimanawas, and over hundreds of thousands of acres lie the bleaching skeletons of once magnificent beech forests. All this area, or most of it, was a liberal contributor of humus to the plains. But the more regulated pace the rivers had attained by deepening their channels was not maintained; the earth's covering on the greater catchment area was burnt off its back; the snow, the frost, the rain, and the winds got at the bare skin of it. The rivers, their beds filled with gravel and silt, ran about the plains once more. One found a new outlet and again abandoned it. River Boards embanked the rivers, treating a symptom and not a disease, and now one river, for a

certain distance, is running several feet above the plain, and when calamity comes it will be miscalled "the act of God."

The matter of deforestation, however, cannot here be dealt with. Long before the coming of the first man the ideal soil, supplied with the necessary four constituents, humus, sand, clay, and carbonate of lime, had arrived for the Heretaunga Plain. This soil, having been supplied from the forest area and the old washed-off inland surfaces, was rich in humus generally over the plain; but a well-defined old river-bed that can be traced from Fern Hill, running through Hastings to Havelock, failed to carry humus in its waterworn gravel subsoil, and it remains to indicate how meagre a base of operations for production of plant-life is afforded by a soil destitute of humus and lacking the coherency afforded by a due proportion of clay. For the most part, however, the humus consolidated the light pumiceous deposits. The carbonate of lime counteracted the sourness generally characteristic of low-lying lands, and assisted in making the plant-food in the soil available. The operations of moisture in proper proportion, warmth, and the valuable carbonate of lime, stimulated the nitrifying bacteria, which change the insoluble nitrogen of the soil into soluble nitrate available for plant-food.

So out of the dim past comes that fine heritage of the people, and nature has built up estuarial soils that chemistry cannot equal or analysis exactly assess, and brought to plants, which have not the power of selection that animals enjoy, that nutriment which is the firmly established base of all our industries.

Passing northward along the coast we find between Wairoa and East Cape the magnificent undulating papa country over which the warm sun shines and the warm rains fall. This in the driest seasons retains its moisture and typical greenness of verdure. True, the country, stripped of its former crown and glory of bush, is on the march, slipping, slipping into the sea. We are there laying up a dreadful legacy of floods, for the rains run from the steep hillsides like thunder-showers from a house-roof. There is one good thing to be said: where slips do occur nature with marvellous rapidity restores the pasture to the bleeding sore. There seems to be a virtue in papa that has not been chemically assessed.

Captain Cook's misnomer "Poverty Bay," as applied to the estuarial land here, is no longer a reproach, for the opulent waters have laid down a silt that is unsurpassed in fertility. The maize-fields deepening into the rich colour of harvest in the subtropical sun have an exotic appearance that is delightful to travellers from the South. The papa ridges roll back from the plain to the virgin bush on the horizon. All along the coast the green of the grass.

seen even from the deck of a passing steamer, delights the eye. A nearer view shows fine clumps of native bush and groves of cabbage-palms dotting the rich pastures. Here nature for the present appears indifferent of human chemistry.

Passing around the Cape we come, after a prospect of poorer hills, to the plain of Opotiki, hither borne from the Urewera country, a soil self-contained and independent, producing fine crops of maize year after year, and asking no return.

Farther along the coast is the great Rangitaiki Swamp, lately reclaimed by affording the Rangitaiki River a new mouth and a straight run to the sea, and basing a system of drains on that outlet. Until recently a great part of the 80,000 acres represented here was under water during the greater part of the year. The land is now rapidly improving in texture, and becoming a great fattening and dairying country. It is also richly supplied with humus, but the much-desired carbonate of lime has not yet appeared to multiply production. The greater part of the swamp foundation is pumice of a considerable depth, washed down from Taupo and the intervening plains and hillsides. There are some pumice outcrops, and the general area is still soil in the making, not likely to be exhausted by starvation or the follies of ignorant agricultural methods.

Hauraki Plain is a deep raupo and flax swamp in the Thames estuary, drained by wide and ample drains, and canals with stop-banks, flood-gates, &c. A straightening of the river has also played its part in this case. Traversing these waterways one may come with sudden surprise on a boat of the black-and-white-funnel line, steaming nonchalantly between the sedgy banks within biscuit-toss of the grazing cattle. Here we shall want lime and more lime. In places the pastures are sour and not as nutritious as they might be, so that cattle may have their stomachs full and still be hungry. This is not to be wondered at when a few years ago sportsmen rowed over places and shot duck where the milking-machines are now operating.

It is really difficult to determine all the conditions that favoured the production of peat in this swamp. However, the peculiar kind of slow decomposition necessary to the formation of peat was in operation in Piako Swamp, producing results similar to those observed at high altitudes under the line of perpetual snow. It is probable that the peat of those northern swamps is so penetrated with roots as to be more imperfect in combustion than the peat of the southern parts of New Zealand.

The deep part of the Piako Swamp formed a lake between two rivers when the Waikato ran through Hinuera down the Thames Valley, making the Matamata Plain, and emptied into the Thames

estuary on the east coast. The Rukuhia Swamp runs inland from Frankton. Of the original lake that once it was, there remain only the waters of the several small lakes about Ngaroto. When the Main Trunk line, which traverses this swamp, was in course of construction the bog swallowed thousands of tons of filling before a bed for sleepers could be laid, and on looking from the rear of a brake-van the line could be seen rising from the weight of the train, and undulating in a way that suggested a floating and precarious surface. Now most of the swamp land here is settled and on the way to fertility. Drainage has accomplished much where the necessary fall was obtainable, but there are still wide expanses of vegetable matter in process of decomposition and lacking in the other constituents necessary to soil-fertility.

On the western coast an effort is being made to bring in the low-lying lands about the mouth of the Waikato. Groynes are being built to increase the scour in the river-channel, and river transport from Waikato Heads is now being resumed, so that the action of steamers may assist in keeping the channel clear, as the old stern-wheelers were supposed to.

One of the finest swamps — really an inland swamp — of the South Auckland district, though not of large area, is the Kawa Swamp, in connection with which a Drainage Board is operating. There is a great fall into the Waipa River. A big main drain and several tributary drains have been cut, and it is certain the whole area will soon be closely settled and producing heavily.

To this purpose of fertile production lime and more lime is required. There are mountains of limestone from Waikato Heads to Mokau. It is used for road-metal and for ballast for railways, and at last farmers are realizing its value in agriculture. In many places even the soil that overlies limestone formation is sour and requires treating with carbonate of lime. Under the limestone cliffs, where lime is made available by atmospheric action, grass is abundant and nutritious. Away from the cliffs, in many places, sufficient lime is not available for the surface soil. Between Waingaroa and Waimai, where a crusher had been at work on limestone probably of a low percentage of lime, crushing it for road-metal, one could tell to an inch where the stone-dust had fallen. The grass accidentally treated was of good colour and increased nutrition. There are, of course, "thin" soils hungry for humus, for which the prescription of lime is not sufficient; but I am satisfied that over the greater part of Auckland Province lime and more lime must be called for.

And after all this talk of soils made and in the making, what is the conclusion?

It was often a matter of wonder to me to see Maoris apparently successfully cropping their lands without manuring them and without exhausting them. (By "successfully" is meant for Maori cultivators.) The secret of this I found in cultivation. The original meaning of manure was "man-œuvre," to till by the hand. That was precisely what the Maoris did. One could not pass a settlement in the cropping season without seeing the women at work in characteristic attitudes literally man-œuvring the soil, aerating it, and so producing plant-food.

The substances necessary for plants are potash, phosphates, and nitrates, and if any one of these three be lacking no superabundance of the others can make good its absence. A complete analysis determines what chemical constituents a soil lacks, but it generally shows that there is a large surplus of plant-food present, in some cases sufficient for scores of crops; so that we are forced to the conclusion that there is a vast difference between the plant-food present and the plant-food in an available form. What has to be determined is the amount of food soluble in the water, and how to render the remainder available for consumption.

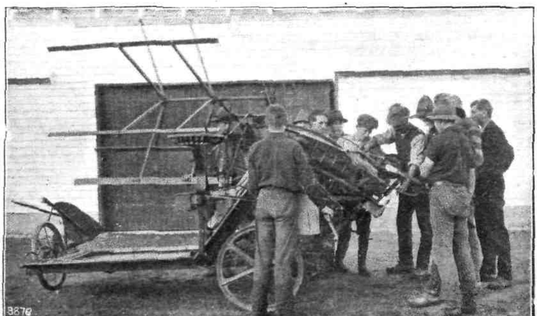
This is just where the scientist comes in, and also where the farmer comes in to co-operate with him. Chemical analysis is not the only way of solving the problems that confront the farmer. The best method of ascertaining the requirements of the soil is by experimenting with growing plants and crops treated with nitrogen, phosphates, and potash alone and combined. Here great care and observation are necessary if the tests are to be of value. Appearances may deceive, but results of feeding and weighing will not. Many farmers manure their lands without any reference to the analysis of manures applied or any clear idea of how to replenish land that has been impoverished by the exhaustion of certain crop-foods. It seems to satisfy them if a certain *weight* of manure is applied.

Though it is not possible for the farmer to keep a profit and loss account for his soil as regards manures applied and plant-foods used up, because the nitrogen (the most important element in plant-food) gains and loses in a way that cannot be so estimated, an intelligent interest in soil-requirements and the composition of manures would be well repaid. Still, no general theory of manuring can be drawn up that will predict the appropriate treatment for every plant beforehand. We must ascertain by experiment the specific requirements of each crop, and adjust the manure accordingly. Soils are naturally classified by vegetation, and I sometimes question the wisdom of revolutionary methods

that may result in failure to successfully grow the higher-value crops on lands that might perhaps be more profitably farmed in a less ambitious manner.

In Great Britain farm lands have for centuries grown characteristic crops according to soil-formation, and the old rotation is still followed. This, though apparently unstudied, is a natural provision made in national as well as individual interests. All successful farming is a result of keen observation, resulting in the survival of the fittest. The savage developed extraordinary powers of observation in the struggle for existence. The Maori was a successful farmer in his primitive way because he was a keen observer. He was naturally, though subconsciously, an embryonic scientist. What we want is observation, experiment, comparison. Nowhere is there a greater diversity of soils over a similar area than in the North Island.

This article was commenced with the thought of the classification of lands into characteristic zones, and separate study of each to assist settlers thereon; also for the purpose of preaching the gospel of lime. It is merely an outline and a suggestion. I do not invade the territory of the scientist. My endeavour is to awaken interest in these estuarial soils, some of which are newly from the furnace of the soil-makers, while others trace their birth to the Æonian granite, upon which the very foundations of the earth are based.



MACHINERY INSTRUCTION AT RUAKURA.

CALVES' VELLS FOR THE RENNET-SUPPLY.

FIRST SEASON'S COLLECTING OPERATIONS.

NOTICES of the Department's campaign, conducted by the Dairy and Live-stock Divisions, for promoting the production of rennet for cheese-manufacture in the Dominion have appeared from time to time recently in the *Journal*. For the purpose of further assisting the dairy industry, represented in this instance by the New Zealand Co-operative Rennet Company, the Department arranged to receive in Wellington the calves' vells saved throughout the country, and to dress, class, and repack them for export. This work was in charge of Mr. H. Munro, Inspector of Stock, Wellington, who also initiated (under instructions from the Director of the Live-stock Division) the series of practical demonstrations of the saving of vells, which were carried out in the dairying districts. The following note on the season's results is contributed by Mr. Munro :—

As a result of the season's operations approximately 25,000 air-dried vells have been secured. Of this number, 23,000 have been exported to England for the manufacture of rennet for the supply of the Dominion, about 1,000 have been used for the manufacture of rennet locally, and the remaining 1,000 comprise those now on hand and some still to come forward.

In the early part of the season a large percentage of the vells came to hand in bad condition, being badly dressed, damp and mouldy, and requiring a lot of attention to put them in a condition suitable for export. A number were also damaged and discoloured, as a result of the calves not being bled and the stomachs not being removed immediately after slaughter. As the season advanced, however, a steady improvement was apparent, and now at the end of the season it can be stated that, while there is still ample room for further improvements, the average condition of the vells secured has exceeded expectations. The quality of vells received from different dairy factories has varied considerably. While lots received from some factories have been consistently good, those from others have been just as consistently indifferent or bad. This may possibly be accounted for by the varying

amount of interest taken in the matter by the different managers and directorates.

In the opinion of the writer, damage to the vells has been due principally to the following causes: (1) Parcelling or packing the vells before they are sufficiently dry; (2) permitting them to get damp in the cases after packing—generally while in transit; (3) exposing them to the sun for drying; (4) applying salt as a safeguard against flies (this prevents them from drying and otherwise damages them); (5) neglecting to bleed the calves, and neglecting to remove the stomachs immediately after slaughter; (6) storing the vells at the factories, and forwarding them to Wellington in packages as received from farmers. The latter practice has been responsible for more damage than any other cause. Factories have repeatedly made consignments composed of small packages tightly wrapped and tied. These parcels had apparently neither been examined nor counted after their receipt from the farmers. In many cases they had been thus parcelled while still damp, and on arrival in Wellington they were found to be mouldy and discoloured, and in some cases in a state of putrefaction and quite useless. A small percentage of vells from new-born calves have come forward. These are not valued, and should be rejected at the factories. Calves should not be killed for rennet purposes under four days old.

While the average quality of the vells has exceeded expectations, the number secured (which probably does not represent more than 9 per cent. of the calves slaughtered during the season) is disappointing to all who have taken an active interest in promoting the manufacture of rennet as a new industry for the Dominion. Now that farmers know what is required, however, better results may be reasonably expected during the coming season. It would indeed be an anomaly if, while relying on outside sources which are subject to interruption, those directly interested in cheese-manufacture should continue to permit the waste of raw material available locally for the manufacture of a commodity so essential to their industry as rennet.

Mr. T. C. Brash, secretary to the Rennet Company, has received advice that the first shipment of vells under the scheme here dealt with arrived in London in good condition.

If money is to be made out of poultry no fowl should be kept after her second laying season. Of course, the good breeding-bird may be kept longer.

CERTIFICATE-OF-RECORD COWS.

THE CURRENT LIST.

W. M. SINGLETON, Assistant Director, Dairy Division.

The appended list completes the records made since the publication of the last list in the November *Journal* up to the end of December, 1916. Some of the cows whose names figure in the present list are commented upon in the writer's annual review of C.O.R. testing published elsewhere in this issue. Many others are worthy of special remarks, but on this occasion, owing to the review claiming most of the space available, readers must be left to form their judgment upon the figures themselves.

LIST OF RECORDS.

Name of Cow and Class.	Tested by	Age at starting Test.		Fat req'd. for Cert.	Yield for Season.		
					Days.	Milk.	Fat.
	FRIESIANS.	Yrs.	dys.	lb.		lb.	lb.
Junior Two-year-old.							
Dominion Margosa ..	Weraroa Experimental Farm	1	351	240·5	324	7,944·25	272·57
Dominion Aaggie Fobes	Ditto	2	29	243·4	314	8,259·75	282·47
Segis Galatea ..	Newton King, New Plymouth	2	20	242·5	365	11,217·10	412·53
Josephine Ruda ..	F. W. Koberstein, Taonui	1	350	240·5	365	9,643·00	453·87
Junior Three-year-old.							
Dominion Florence ..	Weraroa Experimental Farm	3	15	278·5	254	9,621·75	314·54
Countess Alcartra ..	Newton King, New Plymouth	3	51	245·6	314	10,573·30	375·28
Ethel of Friesland Park	F. W. Koberstein, Taonui	3	37	280·7	365	17,063·20	638·85
Senior Three-year-old.							
Clothilde's Alcartra	Newton King, New Plymouth	3	288	305·8	365	12,489·00	469·44
Mutual Maggie of Rock	Sievers Bros., Clareville	3	295	306·5	289	16,242·10	545·41
De Kol Gem Lady Rival	Ditto	3	357	312·7	299	12,827·40	463·51
Junior Four-year-old.							
Heilo Oak Burke Lyons	W. Barton, Featherston	4	55	319·0	255	11,181·60	341·12

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season. Days.	Milk.	Fat.
		Yrs. dys.	lb.		lb.	lb.
FRIESIANS—*continued.*						
Senior Four-year-old.						
Dominion Domino's Pride 4	Weraroa Experimental Farm	4 353	348·8	365	12,688·75	472·75
Woodcrest Aaggie Grace	Ditto	4 341	347·6	308	11,129·25	381·87
Dominion Anna ..	,, ...	4 332	346·7	291	11,350·00	363·66
Mature.						
Dominion Mutual Mercedes of Rock	Weraroa Experimental Farm	5 27	350·0	332	14,649·00	529·76
Beauty Girl ..	Newton King, New Plymouth	6 332	350·0	308	12,714·50	439·07
JERSEYS.						
Junior Two-year-old.						
Miro Meadow's Birdie	A. Wigg, Te Aroha ..	1 358	240·5	344	4,264·20	247·54
Miro Meadow's Dolly	,, ,, ..	1 321	240·5	315	4,694·50	294·24
Myretta	A. Banks and Son, Kiwitea	2 21	242·6	365	7,530·90	417·42
Woodstock's E. Frisk	Ditto	2 8	241·3	347	5,164·60	265·88
Queen of Bulls ..	Dr. F. J. Watson, Bull's	1 333	240·5	365	6,463·00	363·16
Alfriston Noble XXI	R. D. Harkness, Te Horo	2 135	254·0	365	6,855·50	340·35
Silver Patch ..	A. Wighton, Palmerston North	1 331	240·5	365	7,254·80	360·87
Fox's Molly II ..	Ditto	2 84	248·9	321	5,525·80	323·95
Rozel's Sweet Choice	W. V. Harkness, Tariki	2 71	247·6	257	5,305·30	274·97
Lilabelle	James Penney, Blenheim	2 19	242·4	364	4,886·10	296·73
Pencarrow's Favourite	F. E. Day, Tamahere	2 3	240·8	365	6,862·50	349·88
Snow Crest ..	H. Purdie, Brixton ..	1 330	240·5	365	7,386·90	409·87
The Woodland's Belle	R. F. Wilkinson, Pukekohe	1 303	240·5	298	5,284·90	300·57
Miro Meadow's Bluebell	A. A. Ward, Miro ..	2 43	244·8	365	7,064·70	425·04
Friskey Rose ..	H. C. Sampson, Hillsborough	2 9	241·4	365	7,798·80	444·91
Duchess Fox ..	E. M. Spinley, Palmerston North	2 80	248·5	365	8,008·70	431·43
Snow Witch ..	C. A. Willis, Pukekohe	2 50	245·5	332	5,915·60	323·72
Senior Two-year-old.						
Waipiko Myrtle ..	C. G. C. Dermer, Cheltenham	2 339	274·4	365	9,737·90	562·49
Rozel's May Day ..	W. V. Harkness, Tariki	2 356	276·1	275	5,610·50	291·82
Junior Three-year-old.						
Cicero Riotress ..	H. Wells, Onaero, Taranaki	3 15	278·5	365	7,934·30	459·98
Waipiko Estelle ..	F. Adam, Hoanga, Dargaville	3 50	282·0	313	6,382·60	309·83
Waipiko Girl ..	Ditto	3 71	284·1	365	7,924·10	408·55
Miro Meadow's Buttercup	A. A. Ward, Miro, Taranaki	3 26	279·6	365	8,202·10	488·85
Golden Swan's Lilac	A. Moreland and Sons, Papatoetoe	3 47	281·7	341	7,119·50	384·93

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season: Days.	Milk.	Fat.
		JERSEYS—*continued.*				
Senior Three-year-old.		Yrs. dys.	lb.		lb.	lb.
Nettle	F. A. Williams, Levin	3 231	300·1	345	7,094·50	428·88
Snow Girl ..	C. A. Willis, Pukekohe	3 333	310·3	365	10,404·50	557·12
Junior Four-year-old.						
Flandrine's Gift ..	A. Moreland and Sons, Papatoetoe	4 122	325·7	365	11,775·70	544·75
Senior Four-year-old.						
Cuba Gipsy ..	R. D. Harkness, Te Horo	4 234	336·9	365	6,804·50	352·03
Mature.						
Buttercup's Sultane	V. W. Nowell, Hawera	5 331	350·0	360	8,033·20	400·18
Jersey Maiden II ..	A. Banks and Son, Kiwitea	6 8	350·0	350	6,639·70	397·26
Sybil See	Ditto	5 11	350·0	365	12,612·20	595·32
Topsy's Nugget ..	J. E. Gavey, Te Papapa, Onehunga	8–9 yr.	350·0	365	10,682·00	617·66
Briar Lass.. ..	H. C. Sampson, Hillsborough	6 7	350·0	365	9,359·90	490·27
Bilberry X ..	O'Donnell Bros., Inaha	7 331	350·0	293	8,557·90	424·40
Girlie	C. G. C. Dermer, Waipiko	7 323	350·0	352	7,298·00	412·06
Merry Girl ..	F. A. Williams, Levin	8 150	350·0	330	7,060·50	362·76
Golden Flower ..	C. Goulter, Renwick, Blenheim	6 125	350·0	337	8,121·00	462·49
	AYRSHIRES.					
Two-year-old.						
Kanadale Linda ..	Cockburn Bros., Mataura	2 348	275·3	365	12,583·00	502·55
Three-year-old.						
Adelaide II of Waipapa	F. Mills, Hawera ..	3 321	309·1	365	11,604·20	426·68
Mature.						
Dolly of Inglewood ..	F. Mills, Hawera ..	6 246	350·0	365	13,688·80	153·18
	SHORTHORNS.					
Beauty	E. Law, Shannon ..	*	350·0	324	7,800·00	365·73
Nancy	" " ..	7 347	350·0	365	11,314·25	471·72
Beauty	J. R. Anderson, Tiakitahuna	†	350·0	365	13,477·20	551·24

* About 8 years. † Mature.

ARSENICAL SPRAY FOR BLACKBERRY.

THE following formula and method of preparing arsenic solution for the destruction of blackberry by spraying is recommended by the Biologist: Take white arsenic, 1 lb.; washing-soda, 2 lb.; and water, 1 gallon. Dissolve the soda in the water by boiling fifteen to twenty minutes; add the arsenic and boil again until a clear solution is obtained. Use 1 part of this solution to 20 parts of water. This mixture is destructive to all vegetable life with which it comes in contact, and may be effectively used for other purposes, such as killing weeds and grass on garden-paths.

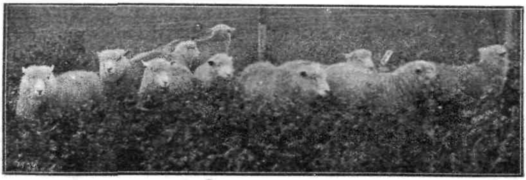
LAMBING ESTIMATES.

ESTIMATES of the average lambing percentages for the 1916 season, as furnished by the Department's Stock Inspectors for their respective districts, are tabulated below, together with corresponding figures for 1915. Comparing the two seasons, it will be noted that in 1916 fourteen districts show a decrease and eleven districts an increase, while seven are stationary.

ESTIMATED LAMBING PERCENTAGES, 1916 AND 1915.

District.	1916.	1915.	District.	1916.	1915.
		North Island.			
	Per Cent.	Per Cent.		Per Cent.	Per Cent.
Ohaeawai ..	72	83	Opunake ..	96	89
Whangarei ..	62	75	Stratford ..	89	88
Auckland ..	85	87	Hawera ..	83½	93
Hamilton ..	93	100	Wanganui ..	90	90
Te Kuiti ..	80	85	Feilding ..	98	98
Tauranga ..	82	75	Palmerston North	89	90
Wairoa ..	78	80	Woodville ..	90	90
Gisborne ..	97	90	Masterton ..	85	90
Hastings ..	85	75	Wellington ..	92	85
New Plymouth ..	94	97½			
		South Island.			
Blenheim ..	78	72	Oamaru ..	70	75
Nelson ..	73	78	Dunedin ..	85	85
Hokitika ..	95	95	Mosgiel ..	70	70
Kaikoura ..	80	91	Gore ..	80	91
Christchurch ..	79	77	Balclutha ..	95	93
Amberley ..	70	55	Invercargill ..	80	80
Timaru ..	85	77			

The estimated total lambing for 1916, based on the number of ewes that were put to the ram, is as follows: North Island, 6,203,726; South Island, 4,551,781: Dominion total, 10,755,507.



WORK FOR THE COMING MONTH.

THE ORCHARD.

J. A. CAMPBELL, Assistant Director, Horticulture Division.

LATE SPRAYING.

ALTHOUGH the spraying season is drawing to a close for a time, the necessity to spray in certain cases will continue more or less throughout the month of March.

In the warmer districts codlin-moth will be found to be still active, and much damage may result if preventive remedies are not continued. In fact, under such conditions spraying is as highly essential during the earlier part of the month, or even later, as it is at any portion of the year. On the other hand, it is a precaution that is too often neglected. When the season is getting on and the different varieties of apples and pears are reaching maturity and are about to be picked the temptation invariably is to cut out an extra spraying if possible. A contributing element to risk in this direction often lies in the fact that the time between the last spraying and picking is scarcely long enough normally to warrant an additional spraying, while at the same time it is too long a period to risk without one. This risk, however, is often run, and the time and trouble of an extra spraying is thereby saved. Unfortunately, this means of saving labour is almost invariably expensive, owing to moth infection taking place to a more or less extent just prior to picking.

Infection of this kind is easily overlooked, and should the fruit be immediately packed a percentage of infected fruit is sure to be included despite the most careful sorting. The only safe means to adopt when such infection does take place is to hold the fruit for a time in order to allow the grub to develop and become more noticeable, thus affording a better opportunity of discarding all the affected fruit. Should this not be done a similar development will take place in the cases, with the result that the whole of the consignment is liable to be condemned on the market. In any case, fruit affected in this way cannot give satisfaction to the buyer.

Woolly aphis is another disease for which spraying will be found necessary in many instances during the month. Winter, however, is the proper season for the control of this and other sucking-

insects. Any form of summer treatment can only be looked upon as a check to keep them within bounds until the time arrives when stronger sprays can be more safely used. Woolly aphis thrives and multiplies rapidly during the summer season, but although this insect appreciates warmth it evidently has an aversion to anything approaching the direct heat of the sun. The ideal conditions for woolly aphis are to be found in a free-growing young tree four or five years old, having a heavy top and furnished with a plentiful supply of soft, succulent inside growths. On the other hand, a tree with an open centre from which the soft growths and water-shoots have been removed will, owing to the direct effect of the sun, be found to be much less affected, and for this reason alone, apart from all other advantages, it is advisable to train an open-centred tree and to remove all defective and useless wood from the centre during the summer.

As stated in previous notes, a nicotine spray, such as "black-leaf 40," combined with arsenate of lead when spraying for codlin-moth, will result very satisfactorily in keeping woolly aphis in check; but for a special application, such as may be required for trees not in bearing, the resin-and-soda solution is to be recommended. This solution should not be applied earlier than February, otherwise serious damage may be done to the foliage. Even after this time slight burning may result, but it is rarely of sufficient extent to be considered serious.

This treatment will also destroy any live red mite that may be on the tree. The latter pest should not be causing much trouble in cases where lime-sulphur or atomic sulphur have been used throughout the season. In this case further treatment may be left to the winter; but where a further check is desirable this may be done by using lime-sulphur or whale-oil soap, the latter in preference, particularly in respect to stone-fruits.

LEAF-EATING INSECTS.

It is now too late to remedy the damage done by pear-slug, but reference is made to it with the object of attracting attention to the destruction it invariably effects to the foliage of the cherry, pear, Japanese plum, &c., when left unchecked. The damage referred to is plainly evident at the present time, and can therefore be more fully appreciated. This or any similar damage to the foliage not only affects the growth of a tree, but also the quality and size of the fruit it bears. Summer pruning can also be placed in this category. In fact, the checking effect that summer pruning has on the growth of a tree is one of the factors that renders it, when intelligently applied, of economic value in

fruitgrowing. Summer pruning, however, is done with an object, and can be guided to suit circumstances: whereas damage as a result of slug, rust, and spray-scorching are general and destructive.

The spraying of young trees for leaf-eating insects is very often neglected owing to the trees not bearing fruit, with the result that many hundreds of young pear, cherry, and plum trees are practically ruined through the ravages of the pear-slug alone before they reach the bearing age. This damage could be easily averted by spraying once or twice during the critical period with ¼ oz. of arsenate of lead to a gallon of water.

CULTIVATION.

The climatic conditions of the present season have varied considerably. In most parts heavy and continued wet weather prevailed for some time. During this period more consideration was necessary in draining away the surplus water than to conserving it for the benefit of the trees. In several districts, however, a sudden change took place; the wet weather was followed by a hot, dry spell, with the result (although the earlier indications did not suggest it) that droughty conditions applied by the end of January. Summer cultivation, where properly attended to, supplied the deficiency of moisture and no great harm was done; but where the conditions of cultivation were otherwise the lack of moisture was felt by the trees. This goes to show that cultivation should not be neglected under any circumstances that will allow of it being carried out. Keep the cultivator going throughout the month, as the trees still require a plentiful supply of moisture to mature their crops, as well as to develop their buds for next season.

POULTRY-KEEPING.

F. C. BROWN, Chief Poultry Instructor.

THE CULLING SEASON.

It should be needless to remind poultry-keepers tha March is a good time for making a general culling of unprofitable stock. Successful culling is undoubtedly one of the chief essentials in profitable poultry-keeping, and with the high prevailing cost of foodstuffs, if this important work is properly carried out, it may easily mean the difference between profit and loss. Second-year hens showing the first signs that their present laying-period is coming to an end should be marketed without delay. This

does not apply to noted breeders. These may be kept until they are three or even four years old, providing their constitutional vigour is unimpaired. Not only should the second-year hens be culled now, but many of last season's pullets can also be weeded out to advantage. In all flocks there are birds which will prove unprofitable to keep beyond the completion of their first laying season.

The rule has already been presented in these notes that the first birds to moult should be the first to be culled, and the last to moult should be retained for breeding purposes. The principle of this rule is borne out by the results of the egg-laying competitions. It will nearly always be found that the birds which commence to moult first are the drones, whereas the last to moult are the heavy profit-makers. Therefore let there be no delay in discarding the drones. Of course, no rule is capable of universal application, and this applies to the late and early moulter. Local conditions must at all times be considered. For instance, the statement that the early moulter is generally a poor layer only applies when the birds are hatched at about the same time and have received uniform treatment in regard to housing, feeding, &c. Any change of quarters or methods of feeding during the autumn will usually bring on an early moult. Do not wait until the moult has properly set in before weeding out the birds that have passed their most profitable period of production. They should be marketed immediately on the first sign of moulting, otherwise their thin and ragged appearance is apt to have an undesirable effect on their market value.

Apart from early moulting, there are other signs suggestive of poor laying-power, such as overfat condition, loose feathering, dull eye, overhanging eyebrow, sluggish appearance, and spare development in the abdominal region. In the case of the breeds with yellow legs, such as Leghorns, Rocks, &c., it will generally be found at this season of the year that those which have lost the deep-yellow colour—the legs having become more or less white and bleached-looking—are the best layers and strongest birds in the flock, whereas those with legs of a rich yellow are the drones. The width of the pelvic bones is also a guide as to whether a bird is concluding her laying-period or not. When the pelvic bones are close together and the breast-bone close up to them it is a sure indication that the bird will not lay for some time. On the other hand, if the pelvic bones are wide apart and there is a good distance between these and the breast-bone, together with a fullness of the abdomen, it is an indication that the bird is laying or will soon commence to lay, and should be retained in the flock until the moulting process commences.

SELECTION OF BREEDING-HENS.—SOME CURRENT WEAKNESSES.

Early in the coming month is an excellent time to select the birds for next season's breeding-pens. This is probably the most important and interesting work that the poultryman has to carry out during his year's operations, for upon the right class of bird placed in the breeding-pen depends largely the success or otherwise of his business. It is a well-known fact that haphazard mating usually results in inferior stock being produced, and consequently reduced profits. Especially is careful breeding imperative at the present time, seeing that there is a prevailing and undoubted tendency in many of our best laying-strains to show signs of deterioration. Even with the popular White Leghorn some of the best strains are giving strong evidence of going back. The chief weaknesses referred to are decreasing size, lack of crop-development, deficiency in breed-type, as well as constitutional weakness.

No doubt the practice of striving after exceptionally high records has been responsible to a considerable extent for much of the weak stock now being bred. This is not to say that breeding in reason for advanced egg-production from a flock generation after generation should necessarily have this undesirable effect. Where the chief and most common danger lies is in aiming for extreme egg-laying capacity, while neglecting the vital consideration of also maintaining breed-type, size, and stamina. It is freely declared, even by some specialist breeders, that there is no such thing as laying-type, and that the year's record is the only thing to go by. This can only be termed nonsense. It is a principle accepted by all who have interested themselves in the advancement of live-stock that only the type which has been bred to a given ideal from generation to generation has the power to transmit desirable characters with any degree of certainty. In selecting breeding-birds some record of performance is certainly essential, but this must go hand-in-hand with breed-type and possession of the necessary size and constitutional vigour. The danger of improving one character at the expense of the other should always be kept in view. While aiming at the ideal laying-form, see that other important features are not sacrificed in the process. There is a limit to which we can go in the laying-capacity of a bird, and if phenomenal layers only are looked for, the power responsible for such capacity will weaken with the impaired constitutional vigour which must result.

No doubt the egg-laying competitions have done good work, and the utility breeders of the Dominion have good reason to congratulate themselves on the manner in which they have converted certain breeds of poultry into special laying-machines. The

problem of the moment, however, is the maintenance of constitution, and it is questionable whether the yearly record put up in the present competitions is a thorough test of this essential factor. For instance, it is not uncommon at the termination of a yearly competition to see in the front rank as performers a more or less weedy pen of birds that are practically broken down owing to the year's egg-laying having impaired their constitutional vigour. On the other hand, pens of birds are to be seen that are probably only a few eggs behind the others, but have ample timber, good breed-type, and constitutional points stamped all over them. It is obvious that such specimens as those of the former category would have no chance of winning a two-years test against birds of the latter description — a trial in which the stamina of the competitors would be taxed to its utmost. Neither could birds of the first category be in any way considered as desirable specimens for a breeding-pen. Even among the specially selected pens in egg-laying competitions, birds of the type of ideal breeders are few and far between; and even these are bound to become less if the existing weaknesses are not corrected in the near future. It would be a forward move if those who are conducting these competitions could see their way clear to run all tests for not less than two years. This is the only way of compelling breeders to pay more attention to size of body and staying-power. After all, in successful poultry-keeping it is not the bird that lays well for one year that is the most desired, but the one that gives a good record for two or even three years.

While no doubt some strains are exhibiting the effect of striving for egg-yield alone by reduction in the size of the birds as well as of the eggs they lay, it is gratifying to know that there are still strains in the country which retain the needed stamina combined with great productive power. The warning, however, is with us, and if we are to preserve the useful and beautiful characters of the breeds at our command to-day we must consider something besides performance, for productive capacity can be attained at too great a cost. The fact cannot be too strongly emphasized that the greater the demand we make on a bird in the way of egg-yield the greater the care we must exercise in seeing that her vigour is not impaired in the process; while every means must be taken to see that she has all the care and attention from the day she leaves the shell (particularly in the matter of housing and feeding), so that she may produce her maximum egg-yield and at the same time retain her breeding-power.

As already indicated, in selecting hens for breeding purposes the moulting-period must be considered as having an important

bearing on production-capacity. It will usually be found that the bird that holds out the longest is the most persistent and longest-seasoned layer. Of course, it is not advisable to choose breeders on late moulting alone, for the late moulter is not necessarily a desirable breeder. The other essential characters already referred to must accompany it. When the most desirable breeders are selected they should be encouraged to moult in order that they may have an opportunity of recuperating. This will enable them to produce early eggs for hatching purposes containing stronger germs than would otherwise be the case. In forcing an early moult a few autumn eggs must be sacrificed, but any loss made in this way is more than counterbalanced by having earlier and stronger chicks, as well as lessening trouble in the incubator and brooder stages by having to deal with weak germs and delicate chickens. One of the best ways of forcing a moult is to give the birds a sudden change of food and a slightly reduced ration, as well as sudden changes of quarters. The advice that the proposed breeders be made to moult should, of course, not be applied to birds in the laying flock. These should be forced for egg-production at all times, except, of course, when they are undergoing the moulting process, or in the case of pullets that have just commenced to lay.

THE BREEDING-COCKEREL.

While the hens for the breeding-pen should be as good as possible, no care is too great in the selection of a male bird. As with the breeding-hen, the first thing to look for is points indicative of constitution. This qualification is indicated by tight, thick feathering, a bold eye, clean face free from wrinkles, shanks short, legs set well apart, well-developed crop, and the possession of a very active disposition. It should never be forgotten that the male is more than half the breeding-pen, as he leaves his influence on every chicken hatched from him. Not only should he be of undoubted stamina and carrying the necessary timber, but he should also be the son of a great layer of good marketable eggs. While feminine characters should be looked for in the female, the sire should be practically at the other extreme, though coarseness should always be avoided. Select the best males from the early broods to head next season's breeding-pens. The late-hatched cockerel seldom makes a desirable breeding-bird. On no account should the selected cockerel be kept in confined quarters. He must be kept in the very best of health, and there is nothing more conducive to this than a good supply of food and ample room to exercise under the most natural conditions possible.

THE APIARY.

E. A. EARP, Apiary Instructor.

FINAL EXTRACTING.

BEFORE taking the last of the surplus honey a careful examination of the colony must be made in order to ascertain the amount of stores available for wintering the bees. Too often beekeepers err in extracting too closely, and feeding has to be resorted to at a later period to make up the amount required to prevent starvation. It takes 30 lb. of honey to winter a colony successfully, and if this amount is increased to 40 lb. there is less likelihood of the bees being short in the spring, while the beekeeper will also be saved a great deal of anxiety and endless trouble in the way of feeding.

Where extracting has been delayed for any reason it is advisable to use great caution in removing the honey. The combs should be removed as expeditiously as possible, and care must be exercised not to incite the bees to rob by keeping the hives open longer than it is necessary to remove the surplus. A hasty examination of the brood-chamber should be made in case it is found that the bees have not filled the combs in the lower story with honey. If empty or partly filled combs are found, it is highly important that they be replaced with good combs of honey from the super. On no account attempt to extract any honey from the brood-chamber. Do not leave combs lying about or expose vessels that have contained honey. Unless caution is exercised in regard to these details, when the final extracting is being done the beekeeper is more than likely to start the bees robbing in a wholesale manner

BEE-ESCAPES.

For removing honey late in the season the beekeeper may find it necessary to bring into use bee-escapes. These escapes enable the honey to be removed without causing any disturbance. By the employment of the Porter bee-escape there is less likelihood of causing robbing, with its attendant evils. More especially will the escapes be found advantageous when removing section honey from the hive. There is far more risk in removing comb honey from the hive than extracted honey. When the colony is disturbed the bees will at once start to fill their sacs, and often the cappings of the sections are punctured in order to secure a supply of honey. The damage to the cappings of sections is unsightly, and causes

the honey to leak after removal from the hive. The escapes are fitted to a board the exact dimensions of the hive in use. In inserting the board gently prize up the super from the brood-chamber and insert the board. A puff of smoke will suffice to control the bees while the operation is being performed. If this is done late in the afternoon the bees will pass through the escape during the night to the brood-nest, and will be unable to return. In the morning the supers may be removed, when practically no bees will be left in the super.

A word of caution to those who have not formerly used the escapes: Should there be brood in the super combs, the bees will not leave, and the escapes will not prove effective in ridding the supers. Over and over again many beginners complain that they cannot get the bees to leave the supers when using escapes, but the reason lies in the fact that no examination had been made to ascertain beforehand whether the super contained honey only.

PREPARATION FOR WINTER.

The time is at hand when it is of paramount importance that proper preparation be made for winter. If the colonies are to winter in good order, so as to escape the abnormal winter losses which sometimes occur, then it behoves the beekeeper to attend to the leading factors that produce successful wintering. The attendant evils of neglect are starvation, spring dwindling, and poor colonies, these latter being of little account when the next season's crop arrives.

There are many factors in preparing the colonies for winter, and among the most important which make for success are a strong cluster of bees, a good queen, plenty of good stores, and protection. It is safe to say that too little attention is paid to wintering the colonies with strong clusters of young bees. Having secured a crop of honey, and noting that the colonies are strong in bees, the beekeeper is satisfied to trust to chance. At the close of the season the colonies are likely to contain a large force of bees, but the majority, having helped to gather the season's crop, are old, and in consequence cannot be taken into account in wintering the colony. As a result, unless large numbers of young bees are being raised to take the place of the old bees, the colonies will seriously dwindle in the spring or become a total loss in the winter. Every effort must be made to keep up breeding well into the winter, and it is often advantageous to stimulate the colonies by autumn feeding.

Next in importance to having a strong cluster of young bees is the necessity for the colony to be headed by a good queen. Too little attention is paid to superseding failing queens. A queen that has laid vigorously during the honey season is likely to become worn out and her powers of reproduction diminished. In all cases these queens should be replaced and a vigorous young mother supplied. It often happens that the bees recognize a failing queen, and set to work to supersede her, but this work should be anticipated by the beekeeper. Other things being equal, stocks headed by a vigorous mother are likely to keep up late breeding, with a result that the colonies will come out in the spring with a prolific queen, and the loss attendant upon queenless hives will be greatly diminished.

If the beekeeper studies his interests and the welfare of his bees he will note that every colony goes into winter quarters with plenty of good stores. This is a most important factor in successful wintering, and upon it depends largely the staving-off of starvation which faces the bees during the months which follow. The colonies that are supplied with honey winter safely and build up early in the spring, and are ready to take advantage of the nectar from the early-flowering plants. Beginners often ask how much honey should be left for the bees to winter on. The amount necessary must to some extent depend largely upon locality, and care must be exercised, more particularly in the South, to provide sufficient food so that winter feeding may not have to be resorted to. In the North winter feeding may be successfully carried out, as there is not the same risk in breaking up the clusters as there is in the extreme South. As already indicated, in no case should a colony be left with less than 30 lb. of sealed honey, and it is wise to increase this amount to 40 lb. Abundance of stores is essential if winter losses are to be eliminated altogether.

Another important factor in the safe wintering of bees is that of protection. This may be provided for bees by housing them in a good watertight hive and protecting them by good shelter-hedges or fences. Great annual winter losses occur in this country through lack of attention to good hives, more particularly to the roofs. Leaky roofs are an abomination, and should not be tolerated under any circumstances. By allowing the roofs to leak the mats and hives become damp, and the consequent drain on the stores is largely in order to keep up the heat of the cluster for safe wintering. It is safe to state that where the bees are kept dry the amount of food consumed to keep up the heat of the cluster will

be small as compared with the stores eaten by the bees where proper protection has not been afforded by the beekeeper. New Zealand in general being a wind-swept country, it behoves the beekeeper to see that the bees are located in a sheltered position. Cold winds militate against brood-rearing, while they prevent the bees from taking a cleansing flight during the spring months.

UNITING COLONIES.

Among the autumn work to be attended to is the examination of the colonies for the purpose of ascertaining if each possesses a laying-queen, and to note those that are too weak to survive the winter. In the negative in either case it is advisable to unite with a stronger colony to save the bees. On no account should an attempt be made to winter weak hives, as they are likely to get robbed out, and this may cause the bees to start robbing when everything in the apiary should be quiet. A simple method of uniting may be practised by placing the weaker hive on top of a stronger one, and placing a sheet of newspaper between the two hive-bodies. In the course of a few days the bees of the weaker colony will gain their way through the paper, and unite peaceably with the bees in the stronger hive. The surplus combs may subsequently be removed and reserved for spring-feeding if required. It is advantageous to destroy the queen in the weak hive prior to uniting.

ROBBING.

At the close of the honey-flow the beekeeper must persistently guard against robbing. Robbing is the result of carelessness, and once it has started is exceedingly hard to check. As mentioned above, do not expose honey, sugar syrup, or anything that the bees can rob. In case wet combs have to be returned to the hives for the bees to clean up, postpone this operation until late in the day, when robbing is not likely to start. See that the honey-house is bee-proof and that all combs and vessels containing honey are removed to a place of safety. Contract all hive-entrances, and especially guard against leaving hives open in a way that they can be attacked by robbers. All operations must be carried out quickly. If robbing has started it is better to postpone all outside work until the apiary is quiet again than to risk extending the trouble by opening the hives. Should a colony be attacked, contract the entrance and pile wet grass in front of the hive. This will usually cure mild cases of robbing, but where a colony has been overpowered by the robbers it should be closed altogether.

THE GARDEN.

W. H. TAYLOR, Manager, Arataki Horticultural Station.

VEGETABLE-CULTURE.

THERE is not much sowing to be done at this time, and practically no planting. Lettuce may be put in, however, and silver-beet can be transplanted, though the latter is not a necessity if the seed has been sown in lines at proper distances apart. Radishes and turnips may also be sown.

In the warmer parts of the Dominion spinach may be sown for several weeks yet, but in other parts it should be up by now. If spinach has not been sown, get it in at once in the places indicated. This is one of the most valuable winter vegetables, is seldom troubled by pests, and remains in use for a long period. Those who have been in the habit of looking mainly to ripe pumpkins and marrows for their winter vegetable would find spinach a valuable as well as an agreeable change.

Turnips for winter use should in most places be sown about the middle of March, perhaps a little earlier in the South and a little later in the North, but the difference of time should not be great. Experience in the warmer part of Hawke's Bay shows that, though crops will make more growth when sown late than in most places, yet they have no material value, as they go to seed before reaching a useful state of development. Advancing crops of all the brassica tribe, which includes the cabbage, should be moulded up as soon as they have made sufficient growth. The moulding-up supports the plants, induces them to make more roots, and covers weeds that may be growing in the rows between the plants as well as those in the spaces between the rows. It also loosens the soil—in fact, it is beneficial in several ways.

Where leeks have been planted in drills these should now be filled by drawing some soil in to them. This will cover any weeds that may be growing in the rows, and, of course, assist in the blanching. The soil may later be drawn up still higher about the leeks, and will lengthen the blanched portion of each. Celery will benefit by plentiful watering while the weather remains dry. The plants should not be moulded up until nearly fully grown—that is to say, until grown to a usable size. Formerly it was the universal custom to mould up by degrees as the plants grew. This plan is now seldom followed, because the plants when not moulded grow stronger, for very obvious reasons. Moulding-up makes watering ineffectual, and prevents rain reaching the majority

of the roots. The plants being large enough for use, they should be moulded up in one operation. There is one earlier operation necessary—that is, a slight moulding when the plants first begin to grow freely; this is to straighten up the lower leaves, which have a tendency to grow out horizontally, and in a later stage are hard to straighten. This, however, is a very minor operation, though quite necessary. Moulding up rows that are sufficiently advanced should be proceeded with. It is of the greatest importance that the soil be pressed very firmly around the base of the plants. This is to prevent bulging of the stems, which causes pithiness, and detracts from the quality of the heads. Care should be taken to bring the leaves together in an upright position, as this keeps the soil out of the centre of the plants.

Summer rhubarb should now be rested, as good growth cannot be expected in the spring if the stalks are pulled late in autumn. Winter rhubarb is now available for use, and I would caution growers of this species of rhubarb not to pull the clumps bare at any time. A few stalks should always be left to keep the roots active.

All rank runners on pumpkins and marrows should be stopped to encourage side-shoots, which bear the fruit.

As the days become cooler it is not so important to keep the soil loose, but it is always wise to keep it clean, to prevent weeds seeding.

SMALL FRUITS.

Remove the old fruiting-canes from loganberries. Light and air tend to ripen up the buds on the new rods. But there should be this proviso: the old rods should not be removed unless there are new rods to take their place; they will fruit twice; but new rods every year are best, and this is the correct practice.

Similar treatment may with advantage be given raspberries. In this case all the old canes should be removed; they only live one year.

Red- and white-currant bushes should be gone over and lateral shoots shortened; cut back to about 6 in. This will have the effect of plumping-up the basal buds, which are the future fruit-bearers. These shoots should in winter be cut back to short spurs, but it must not be done now or the fruit-buds will be likely to break into wood growth.

Strawberries should be prevented making more runners, as late runners will not be strong enough to make good fruiting-plants next season. Cut off the growing tips beyond the last runners formed. When the soil becomes moist the runners wanted should be lifted and planted in nurse-beds of good soil.

Crowded gooseberry-bushes should be relieved by cutting ou branches; the bushes will benefit by the admission of light and air, and it is easy now to judge what number of branches should be removed.

THE FLOWER-GARDEN.

Where carnations have been layered the rooted layers should now be ready to be taken from the old plants. Plant them in nurse-beds in free soil in an open position; they may remain in the nurse-beds till the month of August.

Sweet-peas may be sown in March. For exhibition purposes these are often sown in pots and kept in shelter till spring. The ordinary cultivator may sow where they are to grow, and the result will be good enough for most purposes. The soil should be deeply trenched, drained if required, and if it is possible a fair amount of stable or farmyard manure should be worked in at a low level, so as to encourage the roots to go down deep. In later stages a dressing of "Carmona" or some similar artificial manure may with advantage be applied, but it is not wanted in the early stages of growth. It is not wise to sow the seed too thinly, as there are certain risks of loss, but when the proper furnishing of the rows is assured there should be some thinning-out. If the plants are left 6 in. or 8 in. apart it will be satisfactory.

Seed-sowing in the open ground may be undertaken as soon as the soil becomes moist enough. The sowing may include all hardy annuals, some of which give best results when sown at this time, this being particularly the case with nemesias, which make a very fine display in spring. Carnation-seed sown now should give good flowering-plants for next season; the seed should be sown in boxes for preference, and given the shelter of glass. Carnation-seed as well as many others can be raised in the open ground if the patches are covered with something in the way of a bell glass. Such contrivances are now procurable in a simple form, being merely sheets of glass held in ingeniously contrived wires. Many people would find it easier to raise seed in this way than in boxes, as very little watering is required, and it is watering more than anything else that causes failures.

Chrysanthemums may be given liquid manure occasionally: soot-water is good as a change. Liquid manure should not be given when the soil is dry; it should follow watering with clear water, as manure-water given when the plants are thirsty is apt to cause loss of foliage. Supporting-sticks should be given in good time, for if the growths are allowed to lie on the ground they are not easily got up afterwards.

ANSWERS TO CORRESPONDENTS.

In every instance a question to which an answer is desired in the *Journal* must be accompanied by the full name and the postal address of the inquirer, not necessarily for publication, but as a guarantee of good faith. The question should be written on one side of the paper only.

LUNGWORM IN CALVES.

G. A. EDGE, Paparata :—

I shall be glad if you will kindly inform me of the cause, remedy, &c., in the following case: Several of our calves died within a few weeks. After skinning one we hung it up by the hind legs, and after cutting off its head we noticed a small handful of worms drop on the ground out of the windpipe. Later we found a big fine heifer calf dead, so we cut open her windpipe and found a large quantity of long fine white worms right along the windpipe from the throat right into the lungs. We examined the animal throughout, and everything else seemed to be perfectly healthy. We therefore came to the conclusion that the worms had choked her.

The Live-stock Division :—

Lungworm, as the name implies, is due to the entrance into the respiratory passages of minute worms, scientifically named *Strongylus micrurus*. The eggs of the worm are taken in with the food and hatch out, the embryos finally obtaining access to the lungs. Treatment by medicinal remedies is of no avail. The only treatment of any service in such cases is to endeavour to improve the condition of the animal attacked, and thus render it more resistant to the inroads of the parasite. For this purpose nothing is better than a daily supply of crushed oats and linseed cake, allowing about half a pound of each per day to each of the calves. A salt-lick is also a good provision to make. The paddocks used should be well drained, and those which are likely to have been contaminated by the discharges from the affected calves should receive a top-dressing of lime.

SOWING PASPALUM.—DESTROYING TAUHINU.

W. ANDREW, Upper Plain, Masterton :—

1. I desire to know whether it is advisable to sow *Paspalum dilatatum* with grain in the autumn. The land is light soil on a shingle basis, dries up greatly in the summer, and is all flat and ploughable.

2. Kindly state if there is any remedy for tauhinu beyond cutting and pulling.

The Fields Division :—

1. It is not considered wise to sow paspalum on land that is ploughable and that can grow superior grasses and crops. If your land is not suited for these latter you could sow the paspalum, but even under such conditions there is danger of it being carried on to good land. If you are intent on sowing, you had better sow it in the spring, as if sown in the autumn in your district there is danger of it being injured, if not killed, by the frosts of winter. Sown alone, also, it would have a better chance.

2. Tauhinu could be rolled heavily and finally fired. Failing this, grubbing or cutting and firing is the only means of eradication.

PROPAGATING LOGANBERRIES.

E. W. H., Waimate :—

Will you kindly inform me whether loganberries can be struck from slippings from old canes ? If so, when should the slippings be taken, and how deep should they be planted ?

The Horticulture Division :—

If a few plants only are required they may be obtained by striking cuttings made from the tips of strong shoots about 6 in. long and planted two-thirds of their length in well-worked soil kept free of weeds. If many plants are required, bend the canes down, peg them, and cover with 2 in. or 3 in. of soil. They will then root at every joint. The time for doing this is late autumn.

CLIMATIC RANGE FOR LOQUATS.

S. F. T., Cobden, Greymouth :—

Kindly inform me whether I can grow loquats on the West Coast (South Island), as I have raised some seedlings.

The Horticulture Division :—

In sheltered situations the loquat-tree may grow as far south as Westland, but it will not fruit, or, if it did, the fruit would be of no size. It stands a fair amount of frost. It is grown in garden borders on account of its fine appearance as a foliage-tree as far south as Christchurch. No fruit of any size is obtained from it much south of Auckland. From that city northwards it does fairly well.

GROWING COCKSFOOT FOR SEED.

F. W. HENDERSON, Matakana :—

Will you please let me know whether cocksfoot sown in autumn will give a marketable crop of seed by, say, January next, all going well ; or must it not be cut until its second year ? Is it advisable not to graze cocksfoot intended for seed ? What quantity of seed per acre will be required for ploughed land for a seed crop only ?

The Fields Division :—

On strong soils cocksfoot sown in autumn should provide a satisfactory crop of seed the following January, particularly if the grass is not grazed to any extent. Left until the second year and judiciously grazed meantime, however, it would yield a heavier crop of seed with more vitality. Gathering seed from maiden pasture is not encouraged. Cocksfoot intended for seed could be grazed fairly freely in the early part of the season, but it is only reasonable to thereafter give it ample time to develop stem and abundance of seed. On average land to be seeded with cocksfoot alone sow at least 30 lb. per acre.

RAISING CUPRESSUS MACROCARPA TREES.

B. AND C., Taupaki :—

What time of the year should *macrocarpa* cones be gathered to get seed to plant ; and is it best to plant in boxes or rows in a garden till the plants are one year old, and then transplant ?

The Horticulture Division :—

The cones of *Cupressus macrocarpa* may be gathered any time. Avoid those at the extremity of the branches, as they may not be matured. It is a good plan to cut them across and see their condition. If fit, the white germ of the seed shows up distinctly. The seed may be sown in boxes or in a well-prepared garden soil. Keep clear of weeds. A frame of boards round the bed is helpful to control visits of snails, slugs, &c. Shading with scrim in the early stage of growth may be necessary. Cover the seeds by just sieving enough soil over them to put them out of sight.

LUMPS, OR "PEAS," IN COWS' TEATS.

PERCY J. CUNNINGHAM, Ryal Bush, Southland :—

I have a cow (first calver) that has developed a "pea" in each of her hind teats. Can you tell me the cause, and the best means of getting rid of them? Could they be cut out when the heifer is dry? The peas are getting so large that they are interfering seriously with the flow of milk.

The Live-stock Division :—

In some instances these swellings or lumps are due to the presence of the germ of contagious mammitis. We should therefore advise you to send a sample of the milk from the quarters affected to the Officer in Charge, Veterinary Laboratory, Wallaceville, who would examine the same and advise you accordingly. In the meanwhile the cow should be isolated and milked last.

BUDDING CHERRY-TREES.

H. J. VERNON, Dumbarton, Otago :—

What is the correct time of the season to bud cherry-trees, and when after the buds have taken should the upper part of the tree be cut down with the least chance of bleeding?

The Horticulture Division :—

Cherry-trees are budded in the autumn. In selecting the wood or shoots from which the buds are to be taken see that the growth has stopped—*i.e.*, that new leaves are not being made. What are called ripe buds can then be obtained from that shoot. Cut off the shoot, and select buds from centre of the shoots, avoiding those at the base and tip of the shoot. The upper part of the tree is cut down in the following winter or early spring, when there should be very little bleeding.

ERADICATING WILD OATS.

"SUBSCRIBER," Pareora, South Canterbury :—

Kindly inform me as to the best way of eradicating wild oats. I had 30 acres in wheat this season, and the oats were thick in the crop. Last year there were only a few. We worked the stubble well last autumn; a lot came up then which we grubbed out, and I was surprised to see them so thick in the wheat again this season. Can they be thoroughly eradicated from the land?

The Fields Division :—

Continuous after-harvest cultivation is the only feasible means of killing the wild oat in the land. Failing this carefully carried out, you should give up a season or portion of a season and systematically "summer fallow," thereby killing the pest by periodic cultivation during the heat of summer. Every precaution should also be taken to sow clean seed wheat.

THE BLACK BEE.

"OLD SETTLER," Waitotara :—

I shall be glad if you will kindly give me some information regarding the origin of the small dark-coloured bee called the "black bee." It is rather smaller than the common bee, and distinctly darker in colour, and also rarer. In spite of its smaller size it is much fiercer than the ordinary bee, and can rob the hive of the latter with impunity; also it is such a savage fighter that to rob its hive is a serious matter. This bee existed in New Zealand to my certain knowledge in the year 1880, as I helped to cut down a totara-tree in the Maungakaretu country to get the honey from a colony in a hive about 40 ft. up. They were the most savage bees I ever encountered, and we had to carry smoking moss and rotten wood with us in crates made of supplejack before we could take the honey, of which there was a large quantity.

The Horticulture Division :—

It is evident that the bee you refer to is the black bee, which was introduced into New Zealand about the year 1840 from Australia and England. The bee originally came from middle Europe, on account of which many people call it the "German bee." At certain seasons of the year all colonies and races of bees are extremely vicious, and it is a feasible theory that the colony you robbed out of a totara-tree in 1880 was unreasonably vicious on account of the dearth of a supply of nectar. The same colony would probably have been the most docile and tractable you ever handled if robbed when a plentiful supply of nectar was being gathered. Since the introduction of the black bee into the Dominion it has spread from the North Cape to the Bluff, and is to be found in almost any patch of native bush. It is also largely used for domestic purposes, but is not so prolific as the Italian bee, which is the most suitable for commercial purposes.

GUMMING IN CHERRY-TREES.

"HAPUKU," Puhipuhi :—

Kindly inform me whether there is any cure or preventive for gumming in cherry-trees.

The Horticulture Division :—

There is no direct cure for gumming. All the fruiting varieties of the cherry gum more or less. If a tree is growing and fruiting well a little gum exuding here and there does not necessarily affect its health. Excessive gumming generally follows injury of some kind—the borer getting in, the bark being eaten by crickets or other insects, branches rubbing, or suchlike causes. If a cherry-tree is in an uncongenial badly drained soil, making poor growth, it will gum. Bad drainage is one of the most common causes of gumming. Give your trees the best conditions you can in the way of good cultivation to keep up their growth. This does not mean that a rich soil is required for them. Cherries are more healthy grown in soil of moderate quality.

COAL-ASHES ROUND TREES.

"INQUIRER," Hedgehope :—

Please state whether coal-ashes put on top of the ground around apple-trees for the purpose of keeping down weeds would have any bad effect on the trees.

The Horticulture Division :—

Coal-ashes applied in the way stated would not detrimentally affect the trees unless used to excess.

FORTHCOMING AGRICULTURAL SHOWS.

Masterton A. and P. Association: At Masterton, 20th and 21st February.
Franklin A. and P. Society: At Pukekohe, 23rd and 24th February.
Rangitikei A. and P. Association: At Taihape, 28th February.
Taranaki Agricultural Society: At New Plymouth, 28th February and 1st March.
Rotorua A. and P. Association: At Rotorua, 2nd March.
Hawke's Bay A. and P. Assn.: Autumn Show at Hastings, 6th and 7th March.
North Kaipara A. and P. Association: At Paparoa, 7th March.
Taumarunui A. and P. Association: At Taumarunui, 14th March.
Ashburton A. and P. Association: At Ashburton, 14th and 15th March.
Matamata A. and P. Association: At Matamata, 21st March.
Temuka and Geraldine A. and P. Association: At Temuka, 22nd March.
Methven A. and P. Association: At Methven, 29th March.
Oxford A. and P. Association: At Oxford, 5th April.
Mackenzie County A. and P. Association: At Fairlie, 9th April.
Malvern A. and P. Association: At Malvern, 19th April.

(A. & P. Association secretaries are invited to supply particulars of their show dates.)

AGRICULTURAL BURSARIES.

REGULATIONS under the Education Act for the award of bursaries for the purpose of promoting the study and practice of agricultural science were gazetted last month as follows:—

1. The Minister of Education may grant bursaries under these regulations to duly qualified male students who desire to pursue a further course of agricultural study and practice. Such bursaries shall be termed agricultural bursaries.

2. No person shall be entitled to receive an agricultural bursary unless on the last date on which applications for a bursary are receivable he is over sixteen and not over twenty years of age, and has been resident in New Zealand for not less than twelve months, or unless he produces evidence satisfactory to the Minister as to character and health.

3. The term of a bursary shall be two years, if the holder so long fulfils the prescribed conditions; provided that on the recommendation of the Director or Manager of the farm or institution attended the Minister may extend the term for one year longer.

An agricultural bursary shall be tenable at a State experimental farm, an agricultural college, or some other similar institution under public control in New Zealand that the Minister may approve for the purpose.

4. Every applicant for a bursary under these regulations must satisfy the Minister—

(*a*.) That he has passed the Matriculation examination of the University of New Zealand, or has passed some equivalent examination approved for the purpose by the Minister, or that he has received a higher or lower leaving-certificate issued under the regulations respecting secondary-school certificates; and

(*b*.) That he has satisfactorily completed not less than two years of an approved agricultural or rural course at a secondary school or its equivalent, a technical high school, or the secondary department of a district high school:

Provided that if a sufficient number of candidates qualified under paragraph (*b*) are not forthcoming, a bursary may be awarded to a candidate otherwise qualified who satisfies the conditions of paragraph (*a*).

5. Every application for an agricultural bursary must be on the form provided, must reach the Director of Education, Wellington, not later than the 1st December in each year, and must be accompanied by the necessary certificates of birth and education.

6. Should the number of duly qualified candidates in any year exceed the number for whom accommodation can conveniently be provided, a selection shall be made from the candidates of those most qualified, in such manner as the Director of Education shall determine.

7. Every holder of a bursary shall enter, by his parent or guardian, or some other person approved by the Director of Education, into a bond to return the amount paid in allowances and fees (including a sum at the rate of not more than £40 per annum for board and lodgings, when these are provided) in case he shall fail to complete satisfactorily the prescribed course, or fail to complete within five years after the close of his course service of not less than three years in New Zealand (*a*) as a teacher in a public, secondary, technical, or registered school, or in an agricultural college, or (*b*) as an officer in the Agricultural Department, or (*c*) in farming.

8. Notwithstanding anything to the contrary in these regulations, agricultural bursaries may be awarded without limit of age to students who have satisfactorily completed a course of at least one year at a training college for teachers, and in such cases the tenure of the bursary shall be for one year or two years, as the Minister of Education shall determine.

9. (1.) An agricultural bursary shall be of the annual value of £20, in addition to the amount of the tuition fees (if any) payable by the holder thereof in respect of the approved course of instruction.

(2.) If the holder of a bursary is obliged to live away from home in order to carry out the required course of instruction, he shall, in addition to the amount of the bursary and fees as aforesaid, receive a further allowance at the rate of £30 per annum.

(3.) If board and lodging are provided at the institution attended, there shall be deducted from the amounts named in subclauses (1) and (2) an amount in payment therefor *not exceeding £40 per annum.*

10. An agricultural bursary shall not be tenable with a University Junior Scholarship or any other scholarship, bursary, or exhibition of the value of £20 a year or upwards.

11. If at any time the Director or Manager of the farm or institution at which the agricultural bursary is held reports that the holder has failed regularly to carry out the courses of agriculture required, or has failed to make satisfactory progress in the work, the Minister may forthwith determine the bursary, unless he is satisfied that such failure was due to illness or other sufficient cause; and on such determination no further payment or allowance under the regulations shall be made to the holder of such bursary.

PURCHASE OF SHEEP-SKINS BY GOVERNMENT.

PARTICULARS of the war purchase of sheep-skins in New Zealand by the Government are contained in the following notification by the Hon. W. D. S. MacDonald, Minister of Agriculture, gazetted under date 1st February, 1917. The scheme is based on Orders in Council prohibiting the export of sheep-skins and (except by the Minister's permit) of pelts, also of wool, to any destination.

1. The New Zealand Government (hereinafter referred to as "the Government") is prepared to purchase sheep-skins for and on behalf of His Majesty's Government of the United Kingdom on the terms and conditions and in accordance with the scheme hereinafter set forth.

2. The persons named in the First Schedule hereto, and hereinafter referred to as Government brokers, will act as the agents both of the Government and of the sellers in the purchase of sheep-skins by the Government in accordance with the following provisions.

3. Owners of sheep-skins may deliver them, for sale to the Government, to any Government broker at the broker's receiving depot established at any place specified in the First Schedule hereto.

4. Skins so delivered will be examined and valued by valuers appointed and paid by the Government and hereinafter called "Government valuers."

5. Such skins shall be valued in accordance with the scale of values set out in the Second Schedule.

6. *Any skins so delivered may be rejected by the Government valuer as not* of the class, quality, or condition required by the Government.

7. On any skins being so valued, the Government broker, if duly authorized in that behalf by the seller, will purchase the same on behalf of the Government at the price at which they have been so valued. Such purchase will be effected by posting or delivering to the Controller of Department of Imperial Government Supplies at Wellington an invoice for the skins, together with the Government valuer's certificate of valuation.

8. The property in all skins so purchased shall pass to the Crown so soon as the contract of purchase has been so effected, and the Government broker will thereafter hold them on behalf of the Government.

9. Payment for all skins so purchased shall be made by the Controller of Department of Imperial Government Supplies on the expiry of fourteen days after the date of the contract. Such payment will be made to the Government broker for and on account of the seller, and he shall account for the same accordingly to the seller.

10. The Government broker to whom any skins are so delivered for sale to the Government will act as the agent and on behalf of the seller in doing or causing to be done all things required in respect of the receipt, drying, trimming, and preparation for valuation of such skins and the storage thereof until the sale to the Government has been effected.

11. For all services rendered by a Government broker as the agent of the seller the broker shall be entitled to charge the seller such commission or other remuneration as may be in accordance with the established custom of the trade in the locality.

12. For the purposes of this scheme the Government will, so far as may be thought necessary, grant licenses to fit and proper persons to purchase sheep-skins for resale to the Government under this scheme. Such licenses will be granted on application to the Minister of Agriculture, and on such terms and conditions and on the payment of such fees as he thinks fit to impose, and may be cancelled by that Minister if he is satisfied that any breach of such conditions has been committed by the licensee.

13. No sheep-skins will be purchased by the Government from any person who has himself purchased the same unless—

(*a*.) He was already the owner thereof at the date of this notification; or

(*b*.) He was at the time of purchasing the same the holder of such a license as aforesaid.

14. No skins of sheep slaughtered at a meat-export slaughterhouse will be purchased by the Government under this scheme.

15. In all of the matters herein set forth the Minister of Agriculture will act on behalf of the Government, either by himself or by such person or persons as he may nominate in that behalf.

16. If such supplies of sheep-skins as the Government deems adequate for the necessities of His Majesty's Government are at any time not obtained by way of contract of purchase and sale in accordance with the foregoing provisions, the necessary supplies will thereupon be obtained by way of seizure or requisition in the exercise of His Majesty's prerogative, or in pursuance of the powers conferred by the Regulation of Trade and Commerce Act, 1914, or the War Regulations Amendment Act, 1915 (No. 2), as the case may require.

FIRST SCHEDULE.—GOVERNMENT BROKERS.

Abraham and Williams (Limited).
A. Buckland and Sons.
A. Moritzson and Co.
Bennett and Sherratt.
Bisley Bros.
Buxton and Co.
Canterbury Farmers' Co-operative Association (Limited).
Common, Shelton, and Co. (Limited).
Dalgety and Co. (Limited).
Darling and McDowell.
De Pelichet, McLeod, and Co. (Limited).
Donald Reid and Co. (Limited).
Freeman R. Jackson and Co.
Friedlander Bros. (Limited).
Guiness and Le Cren.
G. W. Binney and Sons.
Hawke's Bay Farmers' Co-operative Association (Limited).
Henderson and Co. (Limited).
H. Matson and Co.
Hugh Roberts.
J. E. Watson and Co. (Limited).
J. G. Ward and Co. (Limited).
J. J. Corry and Co.
Johnston and Co. (Limited).
J. R. Mills and Son.
L. A. Nolan and Co.
Levin and Co. (Limited).
Murray, Roberts, and Co. (Limited).
National Mortgage and Agency Company (Limited).
Newton King.
New Zealand Farmers' Co-operative Association (Limited).
New Zealand Farmers' Distributing Company (Limited).
New Zealand Loan and Mercantile Agency Company (Limited).
North Auckland Farmers' Co-operative (Limited).
North Otago Farmers' Co-operative Association.
Otago Farmers' Co-operative Association (Limited).
Pyne and Co.
Southland Farmers' Co-operative Association (Limited).
Stronach, Morris, and Co. (Limited).
Todd Bros.
United Farmers' Co-operative Association.
Wairarapa Farmers' Co-operative Association.
Waters, Ritchie, and Co.
W. E. Clouston and Co.
Williams and Kettle (Limited).
Wright, Stephenson, and Co. (Limited)

Together with such other persons as the Government may from time to time appoint

RECEIVING-DEPOTS.

Receiving-depots will be established at the following places: Auckland, New Plymouth, Stratford, Wanganui, Feilding, Palmerston North, Gisborne, Napier Dannevirke, Masterton, Wellington, Nelson, Blenheim, Christchurch, Ashburton Timaru, Oamaru, Dunedin, Gore, Invercargill.

SECOND SCHEDULE.—SCALE OF VALUES OF SHEEP-SKINS.

—	Merino Skins.	Half-bred Skins.	Fine Crossbred Skins.	Coarse Crossbred Skins.
	d.	d.	d.	d.
Three-quarter to full-woolled sound skins	10½–11½	13 –14	12 –13	11½–12½
Three-quarter to full-woolled faulty skins	9½–10½	11½–12½	10½–12	10½–11½
Three-quarter to full-woolled damaged skins	8½– 9½	10 –11	9¼–10¾	9¼–10¾
Half-woolled sound skins	8¾– 9¾	11 –12	10½–11½	10 –11½
„ faulty skins	8 – 9	10 –11	8½–10	8½–10
„ damaged skins.. ..	7½– 8½	8½– 9½	7 – 8½	7 – 8½
Short to quarter-woolled sound skins ..	7½– 8½	9¼–10¾	9¼–10¾	8½–10¾
„ faulty skins ..	5½– 6½	7 – 8½	7 – 8½	7 – 8½
„ damaged skins	5¼– 6¼	6½– 7½	6 – 7½	5½– 7
Shorn sound	5¾– 6¾	8 – 9	8½– 9½	8 –10
„ damaged faulty	3 – 4	3 – 6	4 – 7	4 – 7
Lamb-skins sound	11 –12½			
„ damaged	8½–11½			
„ seedy	4½– 9			

Seedy skins are to be valued at lower values according to their condition. Black skins are to be valued according to their proportionate value to ordinary skins of the same class. Condition is to be considered in making valuation.

GOVERNMENT PURCHASE OF CHEESE.

THE terms and conditions under which the Government purchase of New Zealand cheese for war purposes was put into operation are set forth in the following notification by the Minister of Agriculture, Hon. W. D. S. MacDonald, as published in a *Gazette* of date 16th January, 1917, in conjunction with an Order in Council prohibiting the export of cheese except that sold to the Government :—

1. The New Zealand Government (hereinafter referred to as "the Government") is prepared to purchase from the manufacturers, for and on behalf of His Majesty's Government of the United Kingdom, the whole of the stocks of factory cheese now existing in New Zealand or hereafter manufactured in New Zealand before the 1st day of July, 1917, at the price and on the terms and conditions hereinafter set forth.

2. The price to be paid by the Government is, in the case of first-grade full-cream factory cheese, 9½d. per pound, and in the case of second-grade cheese, 9¼d. per pound, delivered at a customary grading-port free on board for direct carriage to the United Kingdom.

3. The cheese shall before shipment be examined and graded in a Government grading-store in accordance with the usual course of trade, and may be rejected as not in conformity with the terms and conditions of the contract.

4. Cheese so shipped shall be consigned to His Majesty's Government in the name of the Officer Commanding, Supply Reserve Depot, Deptford, London, or in such other manner as the Controller of the Department of Imperial Government Supplies at Wellington may from time to time direct.

5. The bills of lading, specifications, and grade-notes for all cheese so shipped shall be delivered by the shipper to the said Controller.

6. Save in the cases hereinafter provided for, cheese so shipped and consigned to His Majesty's Government shall become the property of and be at the risk of

His Majesty on shipment, and shall be paid for so soon as the bills of lading have been delivered to the said Controller, and a contract of sale and purchase on the terms and conditions herein set forth shall be deemed to be constituted by such shipment and consignment.

7. Any manufacturer of cheese may despatch from his factory to a Government grading-store in the usual course of trade any cheese duly marked (in manner required by the Director of the Dairy-produce Division of the Department of Agriculture) as consigned to His Majesty's Government, and in such case the consignment shall become the property of and shall be at the risk of His Majesty so soon as it has so left the factory; and any such despatch of cheese so marked shall constitute a contract for the sale and purchase thereof in accordance with the terms and conditions herein set forth. Cheese so purchased shall be paid for on shipment and the delivery of the bills of lading, specifications, and grade-notes, save that if by reason of insufficient shipping-space or for any other reason it is impossible for the seller to effect shipment thereof within one calendar month after the receipt thereof in the Government grading-store, 90 per cent. of the purchase-money will become payable on demand made by the seller at any time after the expiry of that month, and storage will be paid for by the Government from the expiry of that month until shipment, subject, however, to the following provisions. The storage so payable by the Government shall be at the now current rate not exceeding $\frac{3}{32}$d. per pound per twenty-eight days, or a proportionate rate for any lesser period, and the aggregate amount so payable by the Government in respect of any consignment shall not exceed $\frac{9}{32}$d. per pound. Any storage which may become payable in excess of the above amounts shall be payable by the seller. Notwithstanding anything in this paragraph it shall remain the duty of the seller in all cases to ship the cheese free on board, and in the meantime to use all due care for the safety thereof, in the same manner in all respects as if the property therein had not already passed to His Majesty and as if no payment therefor had already been made.

8. All cheese is to be properly packed by the seller with scale-boards in new export crates of thoroughly seasoned dressed white-pine timber, properly secured, each crate to contain two cheeses of the usual export size, with dividing-board not less than ¾ in. thick between the cheeses, the crate-ends to be bound with wire or hoop-iron, and the battens to be double-nailed to the dividing-boards.

9. The crates are to be branded in such manner as may be directed by the Director of the Dairy-produce Division of the Department of Agriculture.

10. Cheese is to be white or coloured as the said Director may from time to time direct, but in default of any such directions the cheese may be white or coloured as the manufacturer thinks fit.

11. Cheese is to be free from any adulteration whatever, and shall be manufactured not less than fourteen days before packing.

12. The crates shall be marked with the actual cheese-weights, which shall be checked by the Government grader, and payment shall be made on such weights less 2½ per cent. for shrinkage.

13. No cheese will be purchased by the Government except from the manufacturer thereof, nor will any cheese be purchased which has been manufactured elsewhere than at a factory in respect of which an export license under the Order in Council of the 13th day of October, 1916, is in force at the date of the purchase.

14. No cheese will be purchased by the Government which is the subject of a contract for sale and purchase entered into by the manufacturer before the date of the aforesaid Order in Council of the 16th day of January, 191 , and in force at that date, until and unless such contract has been cancelled by the consent of the parties thereto, or such other arrangement has been made in respect thereof as the Minister of Agriculture thinks just and reasonable. If no such cancellation or arrangement is effected within such time as the Minister thinks reasonable, such cheese will be purchased or otherwise acquired by the Government on such terms as may be hereafter determined, and either from the manufacturer or from the purchaser, as the Government may think just in the circumstances of each case.

15. If such supplies of cheese as the Government deems adequate for the necessities of His Majesty's Government are at any time not obtained by way of contract of purchase and sale in accordance with the foregoing provisions, the necessary supplies will thereupon be obtained by seizure or requisition in the

exercise of His Majesty's prerogative, or in pursuance of the powers conferred by the Regulation of Trade and Commerce Act, 1914, or the War Regulations Amendment Act, 1915 (No. 2), as the case may require.

SUPPLEMENTARY NOTICE REGARDING CONTRACTS.

In a *Gazette* of 5th February, 1917, the Minister of Agriculture published a communication that had been made to representatives of contracting parties in the cheese-export trade, as follows:—

With reference to the Order in Council of the 16th January, 1917, prohibiting the export of cheese, which appeared in the *Gazette* of the same date, and also to clause 14 of the notification of the same date by the Minister of Agriculture indicating the terms under which cheese would be purchased on behalf of the Imperial Government (see above), I have the honour to inform you that as I have been advised by the parties concerned that they have been unable to consent to the cancellation of the contracts for the sale and purchase of cheese referred to, or to make any such other arrangements as are provided for in the clause, the Government has decided that it is prepared to purchase from the factories the cheese which is subject to such contracts, and which had not been shipped on the exporting ocean steamer at the date of the coming into operation of the Order in Council—namely, 16th January—at the price fixed by the aforesaid notification—namely, 9½d. per pound, f.o.b.: Provided always that the payment for such cheese shall be subject to a deduction of 1¼ per cent., to be paid by the Government to the other parties concerned in the contracts, by way of compensation for the expenditure incurred by them in respect of such contracts. Subject to such deduction all such cheese will be purchased by the Government on the same terms and conditions as if no such contracts had been entered into.

GRASS-SEED SUPPLIES FOR UNITED KINGDOM.

Cabled advice was recently received from the High Commissioner, London, to the effect that he was informed by the English Board of Agriculture that, owing to Denmark prohibiting the export of cocksfoot and other grass-seed, supplies for the United Kingdom might be deficient. Sowing in New Zealand was suggested. A reply was forwarded by the Department to the High Commissioner substantially as follows:—

The position, so far as New Zealand is concerned, is that our exports of cocksfoot and rye-grass seed could be largely increased without special sowing by merely closing up additional pastures for the purpose; but whether farmers would be prepared to do this would, of course, depend mainly upon the season, the extent to which their pastures were stocked, and the price offered by the United Kingdom. Another source of a large quantity of cocksfoot-seed would be the cutting of the enormous area growing in what may be described as odd corners. This, however, would require special organization of the necessary labour, and would again be largely a matter of price unless it were treated as an affair of national necessity. So far as the present season is concerned the amount of cocksfoot available for export from New Zealand to the United Kingdom will not be great, as it is unlikely that the crop is large. Owing to lack of labour, &c., seed in odd places, aggregating thousands of sacks, will not be harvested. The local demand for cocksfoot will in all probability be comparatively small in 1918, and therefore a large part of that harvested here in that season should be available for export. In normal times between 20,000 and 30,000 acres of cocksfoot is harvested in New Zealand, and if the conditions are favourable next season a large crop should be secured, especially as there is some likelihood that the country as a whole will be rather understocked. The sowing of areas specially for seed is not likely to be undertaken, owing to the shortage of labour for the preparation of the ground. Moreover, it must be remembered that for seed-production cocksfoot pastures should be at least two years old, although under very favourable conditions fair crops can be secured from one-year-old fields. The matter therefore resolves itself into the questions of shutting up additional areas and organizing labour to harvest odd places.

MAXIMUM PRICES FOR WHEAT, FLOUR, BRAN, AND POLLARD.

THE terms of the Government scheme fixing, under war conditions, the maximum prices in New Zealand of wheat, flour, bran, and pollard are set forth in the following Schedules of an Order in Council gazetted on 6th February, 1917, which came into operation on the same date :—

FIRST SCHEDULE.—WHEAT.

1. The maximum price of wheat when sold for delivery free on board at the nearest port and on the usual trade terms as established at the date of this Order in Council shall be the price specified in the Second Schedule to this Order in Council.

2. In the case of wheat sold otherwise than for delivery free on board at the nearest port and on the usual trade terms as established at the date of this Order in Council, the maximum price thereof shall be a price equivalent, as regards the seller, to the price fixed by the last preceding paragraph.

3. In this Schedule the term "nearest port" means the port of entry under the Customs Act, 1913, at which or nearest to which the wheat to which the contract of sale relates, or which is appropriated to that contract, is situated when the contract is made or when the wheat first thereafter comes into the possession or disposition of the seller.

4. This Order in Council shall not apply to a contract for the sale of wheat in a quantity less than 50 bushels, but for the purpose of this exception two or more contracts made at the same time, or substantially at the same time, between the same parties shall be deemed to be one contract.

5. This Order in Council shall not apply to a contract for the sale of seed wheat if such contract is made with the knowledge and approval of the Board of Trade.

SECOND SCHEDULE.—SCALE OF MAXIMUM PRICES FOR WHEAT PER BUSHEL.

	s.	d.
Wheat sold for delivery in February, March, or April, 1917 :—		
Pearl and Velvet	5	9
Hunters	5	8
Tuscan	5	7
Wheat sold for delivery in May, 1917 :—		
Pearl and Velvet	5	9½
Hunters	5	8½
Tuscan	5	7½
Wheat sold for delivery in June, 1917 :—		
Pearl and Velvet	5	10
Hunters	5	9
Tuscan	5	8
Wheat sold for delivery in July, 1917 :—		
Pearl and Velvet	5	10½
Hunters	5	9½
Tuscan	5	8½
Wheat sold for delivery later than July, 1917 :—		
Pearl and Velvet	5	11
Hunters	5	10
Tuscan	[illegible]	9

Wheat sold without express provision as to month of delivery shall for the purposes of this Schedule be deemed to have been sold for delivery in the month in which the contract was made, and the maximum price shall be determined accordingly.

In this Schedule the term "Tuscan" includes all kinds of wheat other than Pearl, Velvet, and Hunters.

THIRD SCHEDULE.—FLOUR.

1. When the nearest port is Christchurch, Timaru, or Oamaru the maximum price of flour as sold by the manufacturer for delivery free on board at the nearest port in 200 lb. sacks on the usual trade terms as established at the date of this Order

in Council shall be £15 per ton, and in the case of sale by the manufacturer otherwise than in manner aforesaid the maximum price shall be a price equivalent as regards the seller to the maximum price above mentioned.

2. In this Schedule the term "nearest port" means the port of entry under the Customs Act, 1913, which is nearest to, or includes, the place of manufacture of the flour sold.

3. When the nearest port is a port other than Christchurch, Timaru, or Oamaru the maximum price of flour as sold by the manufacturer for delivery free on board at the nearest port in 200 lb. sacks on the usual trade terms as established at the date of this Order in Council shall be £15 per ton, with such addition only as is equal to the cost of the carriage by sea of a ton of flour from Lyttelton to the said nearest port; and in the case of sale by the manufacturer otherwise than in manner aforesaid the maximum price shall be a price equivalent as regards the seller to the maximum price last above mentioned.

FOURTH SCHEDULE.—BRAN AND POLLARD.

1. When the nearest port is Christchurch, Timaru, or Oamaru the maximum price of bran and pollard as sold by the manufacturer for delivery free on board at the nearest port on the usual trade terms as established at the date of this Order in Council shall be £4 per ton in the case of bran and £6 per ton in the case of pollard, and in the case of sale by the manufacturer otherwise than in manner aforesaid the maximum price shall be a price equivalent as regards the seller to the maximum prices above mentioned.

2. In this Schedule the term "nearest port" means the port of entry under the Customs Act, 1913, which is nearest to, or includes, the place of manufacture of the bran or pollard sold.

3. When the nearest port is a port other than Christchurch, Timaru, or Oamaru the maximum price of bran or pollard as sold by the manufacturer for delivery free on board at the nearest port on the usual trade terms as established at the date of this Order in Council shall be £4 per ton in the case of bran and £6 per ton in the case of pollard, with such addition only as is equal to the cost of the carriage by sea of a ton of bran or pollard, as the case may be, from Lyttelton to the said nearest port; and in the case of sale by the manufacturer otherwise than in manner aforesaid the maximum price shall be a price equivalent as regards the seller to the maximum price last above mentioned.

REGULATIONS RELATIVE TO SALE.

The following regulations relative to the sale of wheat, flour, bran, and pollard were also made by Order in Council in connection with the fixation of maximum prices, and gazetted on 6th February, 1917, coming into operation that day:—

1. (1.) Every person who, whether as a principal or an agent, and whether personally or through an agent, enters into any contract for the purchase of wheat shall, within seven days after the day of the making of that contract, send or cause to be sent to the Board of Trade, by means of a letter posted and addressed to the Secretary of that Board at Wellington, a notification of such contract containing the following particulars:—

(*a.*) The names and addresses of the purchaser and seller;
(*b.*) The date on which the contract was made;
(*c.*) The class and quantity of wheat so purchased;
(*d.*) The agreed date and place of delivery;
(*e.*) The price of the wheat;
(*f.*) The price of the sacks;
(*g.*) Particulars of any terms or conditions which are not in accordance with the established custom of the trade at the date of these regulations;
(*h.*) If the contract is made or evidenced by any written document, a copy of that document;
(*i.*) *A declaration made by or on behalf of the purchaser that the price of the* wheat is not in excess of the maximum price as fixed at the date of the contract by any Order in Council made under the Regulation of Trade and Commerce Act, 1914.

(2.) Every person who makes default in sending or causing to be sent a notification in accordance with the foregoing provisions, or who sends or causes to be sent to the Board of Trade any such notification which is false or misleading in any particular, shall be guilty of an offence against these regulations, and shall be liable accordingly.

(3.) *Nothing in this regulation shall render necessary a notification of any* contract for the purchase of wheat in any quantity less than fifty bushels, save that two or more contracts made between the same parties at the same time, or substantially at the same time, shall be deemed to be one contract for the purpose of this exemption.

2. (1.) Every manufacturer of flour, and every agent of a manufacturer of flour, who, whether by himself or an agent, enters into any contract for the sale of flour, bran, or pollard shall, within seven days after the end of the calendar month in which that contract is made, send or cause to be sent to the Board of Trade, by means of a letter posted and addressed to the Secretary of that Board at Wellington, a notification of such contract containing the following particulars:—

(*a.*) The names and addresses of the purchaser and seller;
(*b.*) The date on which the contract was made;
(*c.*) The quantity of flour, bran, or pollard so purchased;
(*d.*) The agreed date and place of delivery;
(*e.*) The price;
(*f.*) Particulars of any terms or conditions which are not in accordance with the established custom of the trade at the date of these regulations;
(*g.*) A declaration made by or on behalf of the seller that the price is not in excess of the maximum price of the goods so sold as fixed at the date of the contract by any Order in Council made under the Regulation of Trade and Commerce Act, 1914.

(2.) Every person who makes default in sending or causing to be sent a notification in accordance with the foregoing provisions, or who sends or causes to be sent to the Board of Trade any such notification which is false or misleading in any particular, shall be guilty of an offence against these regulations, and shall be liable accordingly.

3. Every person who, whether as principal, agent, or otherwise, buys or sells or is in any manner concerned in the buying or selling of wheat, flour, bran, or pollard at a price in excess of the maximum price thereof as determined by any Order in Council for the time being in force under the Regulation of Trade and Commerce Act, 1914, shall be guilty of an offence against these regulations, and shall be liable accordingly.

4. (1.) The Minster of Agriculture or any member of the Board of Trade may require any person to give to him information relative to the sale or purchase of any wheat, flour, bran, or pollard, whether by the person so required to give information or by any other person, and it shall be the duty of all persons when so required to give all such information in their possession accordingly.

(2.) Every person who makes default in giving any such information when so required, or who, whether so required or not, gives any false or misleading information to the Minister of Agriculture or to any member of the Board of Trade relative to the sale or purchase of any wheat, flour, bran, or pollard, shall be guilty of an offence against these regulations, and shall be liable accordingly.

5. For the purposes of these regulations an option for the sale or purchase of any goods shall be deemed to be a contract for the sale and purchase thereof, and these regulations shall apply accordingly.

PRICE OF MILK IN WELLINGTON AREA.

An Order in Council dated 18th January, 1917, fixed the maximum wholesale price of milk for retail distribution within the boroughs of Wellington, Miramar, Karori, Onslow, Lower Hutt, Petone, and Eastbourne, the town districts of Johnsonville and Upper Hutt, and the counties of Hutt and Makara, at 10½d. per gallon when sold and delivered on the usual trade terms as established at the date of the Order. In the case of milk sold otherwise than on such usual trade terms the maximum wholesale price is to be equivalent, as regards the seller, to 10½d. per gallon.

Export of Cereals prohibited.—An Order in Council dated 8th February, 1917, prohibits the exportation of wheat, oats, and other cereals, also of flour, and of oatmeal, crushed oats, rolled oats, and similar preparations, save with the consent of the Minister of Customs.

Month.		Mutton, Carcases.	Lamb, Carcases.	Beef, Quarters.	Pork, Carcases.	Butter, Boxes.	Cheese, Crates.	Wool, Bales.	Wheat, Sacks.	Oats, Sacks.	Rabbits, Crates.	Hemp, Bales.	Tow, Bales.	Kauri-gum, Pkgs.
January,	1917	252,769	149,203	57,555	620	155,214	77,048	52,546	..	..	12,366	4,621	729	2,003
,,	1916	166,700	295,170	41,726	179	108,593	101,917	92,849	..	..	..	7,438	1,666	1,218
February,	1916	170,973	266,414	29,056	23	96,096	84,740	96,016	..	..	..	8,161	1,804	1,900
,,	1915	433,585	517,581	77,421	311	119,371	96,090	159,347	..	..	..	13,111	6,619	2,763
March,	1916	327,977	363,269	83,725	..	59,671	62,082	49,750	..	..	474	2,666	637	1,247
,,	1915	80,439	203,480	30,176	..	55,280	51,811	49,809	..	..	..	8,410	185	274
April,	1916	108,488	195,707	106,369	..	24,703	81,652	41,725	..	..	..	3,782	337	450
,,	1915	286,155	328,779	45,340	..	6,703	38,561	41,371	..	..	1,011	9,328	1,474	3,461
May,	1916	170,164	282,156	134,971	..	26,789	56,961	26,356	..	..	1,000	2,892	235	731
,,	1915	257,953	433,831	34,780	655	148	17,065	21,615	..	..	2,923	4,968	808	2,636
June,	1916	138,303	290,319	41,593	..	10,289	18,463	22,998	..	..	5,439	5,260	2,076	1,219
,,	1915	99,080	154,785	19,316	932	..	26,869	11,946	..	..	9,800	5,027	1,320	1,229
July,	1916	367,827	593,670	42,322	..	4,209	30,940	50,804	..	..	10,950	9,244	3,720	3,230
,,	1915	243,420	340,476	21,231	154	..	21,520	16,039	..	..	5,968	5,068	1,639	4,184
August,	1916	238,926	266,390	76,755	..	9,810	32,178	18,713	3	..	9,725	7,463	1,868	3,293
,,	1915	510,418	570,381	51,750	35	..	18,287	19,416	..	..	31,790	7,138	1,466	4,848
September,	1916	272,848	163,852	75,422	..	185	..	6,786	7,421	..	23,445	4,494	2,428	1,123
,,	1915	299,715	330,643	59,487	..	26,416	2,595	5,360	..	..	7,750	2,022	3,091	595
October,	1916	190,290	132,429	60,670	..	50,667	34,459	11,600	12,596	..	11,599	8,417	5,786	2,138
,,	1915	367,198	417,794	87,104	..	111,468	49,160	7,272	..	..	56,636	5,650	1,645	1,230
November,	1916	168,447	218,660	26,301	..	123,181	60,277	11,772	..	..	11,495	8,571	3,523	3,953
,,	1915	93,777	92,601	21,609	..	81,102	47,243	18,715	..	..	13,538	5,064	1,780	868
December,	1916	94,838	201,119	3,576	..	119,155	30,492	15,401	..	..	16,244	2,933	275	1,860
,,	1915	91,124	59,231	36,467	..	214,967	81,939	33,527	..	..	3,052	6,016	1,940	5,555

LONDON MARKET VALUES.

COMPARATIVE STATEMENT COMPILED FROM THE HIGH COMMISSIONER'S CABLES FOR THE PAST THREE MONTHS.

London Date.	Wool. Per lb. Bradford Quotations for Tops.						Mutton. Per lb.		Lamb. Per lb.		Beef. Per lb.		Butter. Per cwt		Cheese. Per cwt.			Hemp (Spot). Per ton.			Hemp (Forward Shipment). Per ton.			Wheat. Per qr.		Oats. Per qr.	
	36's.	40's.	44's.	50's.	56's.	60's.	Canterbury.	North Island.	Canterbury.	Other than Canterbury.	New Zealand Hinds.	New Zealand Fores.	Danish.	New Zealand.	New Zealand White.	New Zealand Coloured.	Canadian.	New Zealand Good-fair.	New Zealand Fair.	Manila Fair (New Grade).	New Zealand Good-fair.	New Zealand Fair.	Manila Fair (New Frade).	N.Z. Short-berried.	N.Z. Long-berried.	N.Z. Sparrowbills.	N.Z. Danish.
							d.	d.	d.	d.	d.	d.															
1916. Nov. 11	..	..	..	..	..	..	*8⅝	..	*9½	..	7⅛	6¼	217/0	203/0	..	..	118/0	53/0/0	51/0/0	54/10/0	52/0/0	50/0/0	53/10/0	..	..	*40/0	..
" 18	..	..	..	..	..	..	*8⅝	..	*9½	..	..	..	216/0	..	..	..	122/0	53/0/0	51/0/0	55/0/0	52/0/0	50/0/0	54/0/0	..	..	*41/0	..
" 25	..	..	..	..	..	..	*8⅝	..	*9½	..	7	6	219/0	..	..	..	127/0	53/0/0	51/0/0	56/10/0	52/0/0	50/10/0	56/0/0	..	..	*41/0	..
Dec. 2	..	..	..	..	..	..	*8⅝	..	*9½	..	7¼	6¼	219/0	..	..	..	127/0	54/0/0	52/0/0	58/0/0	53/0/0	51/0/0	57/0/0	..	..	*46/0	..
" 9	..	..	..	..	..	..	*8⅝	..	*9½	..	7⅜	7¼	221/0	211/0	..	..	131/6	54/10/0	52/10/0	58/10/0	54/0/0	52/0/0	57/10/0	..	..	*48/0	..
" 16	..	..	..	..	..	..	*8⅝	..	*9½	..	7⅛	7	221/0	215/0	..	..	133/6	59/5/0	55/0/0	60/0/0	56/0/0	53/0/0	59/0/0	..	..	*48/0	..
" 22	..	..	..	..	..	..	*8⅝	..	*9½	..	..	..	221/0	215/0	..	..	133/0	58/0/0	55/0/0	59/10/0	54/0/0	52/0/0	58/0/0	*80/	..	*50/0	..
" 29	..	..	..	..	..	..	*8⅝	..	*9½	..	..	..	219/0	213/0	..	..	..	..	..	..	..	..	..	..	..	..	..
1917. Jan. 6	..	..	..		..	..	*8⅝	..	*9½	..	..	..	218/0	208/0	..	..	134/6	60/0/0	58/0/0	..	59/0/0	57/0/0	60/0/0	*80/	..	*50/0	..
" 13	..	..	..	..	..	..	*8⅝	..	*9½	..	†8	†7	219/0	205/0	..	..	139/0	60/0/0	58/0/0	62/0/0	59/0/0	57/0/0	60/0/0	..	..	*50/0	..
" 20	..	..	..	..	..	..	*8⅝	..	*9½	..	..	..	219/0	203/0	..	..	142/0	..	..	..	59/0/0	57/0/0	60/0/0	..	..	*51/0	..
" 27	..	..	..	..	..	..	*8⅞	..	*10	..	..	..	219/0	194/0	..	..	143/0	..	..	..	60/0/0	58/0/0	62/0/0	..	..	*51/0	..
Feb. 3	..	..	..	..	..	..	*8⅞	..	*10	..	..	..	219/0	199/0	..	..	148/0	..	..	..	62/0/0	60/0/0	72/0/0	..	..	*51/0	..
" 10	..	..	..	..	..	..	*8⅞	..	*10	..	..	..	..	..	..	..	155/0	66/0/0	64/0/0	..	66/0/0	64/0/0	80/0/0	..	..	*51/0	..

ESTIMATED YIELDS OF WHEAT AND OATS.

THE following estimated average yields of wheat and oats for the current season, 1916–17, have been compiled by the Government Statistician from reports furnished by the Fields Inspectors of the Department of Agriculture :—

	Bushels per Acre. Wheat.	Oats.		Bushels per Acre. Wheat.	Oats.
Auckland	.. 24·50	29·47	Marlborough	.. 25·19	43·17
Hawke's Bay	.. 20·38	30·78	Canterbury	.. 24·31	30·13
Taranaki	.. 22·26	32·59	Otago ..	.. 29·73	32·84
Wellington	.. 23·58	34·13	Southland	.. 27·49	29·54
Nelson	.. 20·00	30·00			
Average (estimated) for Dominion, season 1916–17	25·15	30·88	Average (actual) for Dominion, season 1915–16	.. 21·59	35·98

According to the above estimates, taken in conjunction with the acreage grown, the total yield for the Dominion should be approximately as under, the figures for the previous season being given for comparison :—

	Wheat. Bush.	Oats. Bush.		Wheat. Bush.	Oats. Bush.
Estimate yields, 1916–17	.. 5,400,000	5,600,000	Actual yields, 1915–16	.. 7,108,360	7,653,208

STOCK EXPORTED.

THE following table shows the numbers and descriptions of stock exported from the Dominion during the month of January, 1917 :—

Port of Shipment.	Horses. To Australia.	Horses. To Eastern Pacific.	Sheep. To Australia.	Sheep. To Eastern Pacific.	Sheep. To San Francisco.	Cattle. To Australia.	Cattle. To Eastern Pacific.	Pigs. To Eastern Pacific.	Pigs. To Australia.
Auckland ..	1	4	..	63	..	..	19	34	..
Wellington ..	..	..	8	..	..	..	..	..	..
Lyttelton ..	..	..	189	..	..	..	..	..	..
Dunedin ..	12	..	135	..	..	1	..	..	..
Bluff ..	3	..	..	..	..	..	..	..	..
Totals ..	16	4	332	63	..	1	19	34	..

The following are particulars of horses shipped: 8 draught colts and 8 mares, 1 thoroughbred mare, 1 Clydesdale colt and 2 mares.

STOCK IN QUARANTINE.

THE following stock was received into quarantine during the month of January, 1917 :—

No.	Description.	Sex.	Port of Origin.	Owner or Agent.	Address.
			QUAIL ISLAND (LYTTELTON).		
1	Shorthorn bull..	Male ..	London ..	J. C. N. Grigg ..	Longbeach.
1	" cow..	Female	" ..	" ..	"
1	" calf..	"	" ..	" ..	"
2	" heifers	"	" ..	" ..	"
2	" "	"	" ..	Hon. Dr. McNab..	Knapdale
2	Collie dogs ..	Male ..	" ..	J. Lilico ..	Lochiel.

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SURFACE-SOWN GRASS-MIXTURES.

SOME RECENT CHANGES.

A. H. COCKAYNE, Biologist.

DURING the past twenty years very considerable modifications have been made in the constitution and type of grass-seed mixtures used for the sowing of bush-burns and other surface-sown lands where firing is the only method of preparing the seed-bed. It seems well to consider in detail some of the more important changes and determine some of the reasons that have led to their adoption. During the period under review some five million acres have been converted from forest, scrub, and fern into grass land, and there is still a huge area to deal with. In this article I treat only of some of the most salient features of present-day bush-burn mixtures, not with any idea that the present opinions are all likely to be permanent, but merely to show the present position of some special phases of the matter

INCREASE IN AMOUNT OF SEED SOWN.

The greatest change that has occurred during the past twenty years in the seeding of bush-burns is the increase in the amount sown per acre. In the late "nineties" it can be said that 20 lb. of grass-seed per acre represented the average amount used, while at the present time the average quantity approaches 30 lb. This is true of nearly all the surface-sowings of the present time, with the exception of those in Hawke's Bay and Poverty Bay, where 20 lb. and less is still the prevailing practice. There has been much argument as to whether the present tendency of increasing the quantity sown is sound, and opponents of the new system point to many excellent old-established pastures that were sown with not more than from 15 lb. to 18 lb. of seed. Still, in earlier days stocking was by no means as heavy as it is at the present time, and much natural seeding occurred, a condition that is now unusual on the average bush-burn. Again, in many cases weeds were not so troublesome in earlier times, and the likelihood of thin pastures running into fern or piripiri (hutiwai) was by no means so general as it is to-day.

Personally, I consider that the heavier sowings are fully justified, and that the whole secret of successful grassing of surface-sown country is to get as thick a sole of grass as possible within the first two seasons after sowing. The common argument that such-and-such a grass or clover will come in naturally is often quite unsound. While one is waiting objectionable vegetation that may take years of hard work to get rid of often makes its appearance, a condition that would not arise were a thick sole of grass developed rapidly. The fact that an increase in the quantity sown has become generally adopted over millions of acres indicates clearly that this procedure is giving good results, and the inference that heavy sowings are in reality sound and economical seems beyond question. The increased amount of seed sown per acre at the present time represents an increase of over 1,000 tons per annum on our bush-burns alone.

LIMITATION OF RYE-GRASS.

For many years after the establishment of our bush-burn-sowing method of grassing forest lands perennial rye-grass was the main seed used. It was not until the late "nineties" that it was recognized that on very large areas of country, especially in the North Island, rye-grass would not hold and must be treated as at best a semi-permanent grass. Certainly the reduction in the use of perennial rye-grass is one of the outstanding features of

present-day bush-burn mixtures. It has to be admitted, however, that this has not been caused by a falling-off in estimation of the grass so far as the farmer is concerned, but purely through his recognition that it is only the better lands on which it is likely to be permanently successful. My personal opinion is that the value of rye-grass has been exaggerated on all classes of country except those of the very highest quality. At the present time the quality of bush-burn land grassed is on the average distinctly inferior to much of that dealt with twenty years ago, and I would not be surprised at a still further reduction in the use of perennial rye-grass in the future. So far as Italian rye-grass is concerned, the case is very different. Sown purely as a temporary element of the pasture, it fulfils a very valuable function, and should be included in all mixtures in which any perennial rye-grass is sown. During recent years there has been a notable increase in the amount of Italian sown, and this tendency is likely to be more than maintained.

COCKSFOOT TO THE FORE.

The thorough recognition of the fact that perennial rye-grass must in most instances be treated virtually as a temporary grass has led to a great increase in the amount of cocksfoot used in mixtures. At the present time 14 lb. per acre is occasionally sown, and 10 lb. may be looked upon as quite usual on bush-burn country. Less than twenty years ago 6 lb. of cocksfoot was looked upon as a heavy seeding for this grass, so that the increase in the employment of cocksfoot is one of the most outstanding alterations that has occurred. There is little doubt that cocksfoot is the king of pasture grasses in New Zealand; but, being naturally of a tussocky nature, its more widespread use of recent years has demanded an increase in the employment of bottom grasses to fill up the interspaces and form a uniform sward. In consequence of this a great increase is manifest in the sowing of crested dogstail, and, to a less extent, of the poas.

INCREASE OF SPECIES USED.

Quite one of the characteristic features of bush-burn grass-mixtures at the present time is the very large number of species included in each sowing. This is in marked contrast to the procedure of earlier times, when the aim seemed to be the restriction of individual species, until in many cases, so far as grasses were concerned, rye-grass and cocksfoot were the only ones sown. A large number of species in a mixture seems a

sound policy, especially in such a country as New Zealand, where the pastures are grazed the year round. In certain localities where unfavourable weather stops growth during considerable portions of the year a mixture consisting of few species might be advisable. There is no doubt, however, that in many cases—and this refers especially to newly opened-up country—mixtures containing an excessive number of species are largely experimental. The farmer considers he is on the safe side by trying as many kinds as he thinks might succeed. In nearly every case, however, he is careful to make cocksfoot the basis of his mixture. How strongly the farmer relies on cocksfoot is emphasized when it is remembered that a 10 lb. sowing of cocksfoot is equal in number of plants and in covering-capacity to approximately 23 lb. of rye-grass. There is little doubt, however, that the sowing of what might be termed these experimental mixtures has had the result in general of increasing the number of species used. In many districts this "hit or miss" method of determining the most suitable grasses has led to certain ones becoming regularly used, while in others they may rarely be sown. The use of meadow-foxtail and *Poa trivialis* in the Taumarunui district is a case in point.

DECLINE OF CHEWINGS FESCUE.

One of the most notable features in grass-mixtures has been the very considerable restriction in the use of Chewings fescue. Although nearly as much seed of this grass is produced as in former years, the greater bulk is now exported, having entered into successful competition on European and American markets with sheep's, red, and hard fescues. The peculiar vagaries with regard to the germination of Chewings fescue after being stored a season have caused overseas merchants during the past two or three years to be rather suspicious of this seed, but in this respect it differs little from other members of the fine-leaved fescue family. At one time, excepting rye-grass, cocksfoot, and timothy, it was more largely used than any other grass, being ranked as of great value on all types of second-class land. It is probable that the more extended use of danthonia has had more than anything else to do with its present restricted use of Chewings fescue on poor land, while on the better classes of second-grade country crested dogstail has largely replaced Chewings.

Although to a large extent ousted by other grasses that are now considered superior, Chewings has itself more or less taken the place of other fine-leaved fescues, such as sheep's, red, and hard, which are now rarely sown. If a fine-leaved fescue is to

be used there is no doubt that Chewings is superior to any of these imported species. So far as sheep's fescue is concerned, the name was the main cause of the seed being originally used in quite considerable amounts in New Zealand. Chewings is still fairly extensively used in lawn mixtures, but even for this purpose it is not as popular as it was a decade ago, one or other of the species of *Agrostis* having largely taken its place. There is no doubt that on certain soils Chewings is an exceedingly useful grass, but, as with many of the poorer grasses, it is only the young herbage that is really acceptable to stock. If it is allowed to get away, sheep often become extremely poor in condition when grazed on pastures composed mainly of this grass. On poor beech (birch) country, provided there is an abundant rainfall, Chewings is one of the best grasses to sow, being more easily and rapidly established than danthonia, and on such country its former popularity is more than likely to be regained.

RISE OF DANTHONIA.

The natural changes that have occurred and are still occurring over wide areas of originally surface-sown country have had a great influence on changes in the general constitution of grass-seed mixtures used at the present day. In not every case has the final domination of any particular grass led to its more general adoption in mixtures; but, on the other hand, in certain instances species that have naturally more or less replaced the dominant elements in the original sowing have been incorporated as important members of the present-day sowings. Over very large areas originally sown with, say, 12 lb. of rye-grass, 4 lb. of cocksfoot, and a couple of pounds of clover the present constituents of the pasture in no way correspond to the seed sown. In many instances a transition stage to bracken, fern, or piripiri has held sway for a few years, and then gradually danthonia (mainly *Danthonia pilosa* in one or other of its forms) has made its appearance, until to-day the pastures consist almost entirely of this grass.

This change has occurred over hundreds of thousands of acres both in the North and South Islands, and forms one of the most notable instances of how nature attempts to cover the ground with the plant most suitable to the conditions, notwithstanding any efforts man may make other than by altering the general conditions of the habitat. The remarkable way in which danthonia spreads naturally on poor ground, converting the existing vegetation into serviceable pasture, was one of the main causes of attention being devoted to the sowing of native grasses. To begin with, *Danthonia semiannularis* and rice-grass (*Microlaena stipoides*) were the two

most widely adopted. In the early part of this century it was recognized that *Danthonia pilosa* was by far the best of any of our native grasses, and there sprang up a very large demand for it. To-day *pilosa* has (excluding the rye-grasses and cocksfoot) taken its place as one of the most important of the grasses, so far as the amount annually sown is concerned.

There are even to-day many opponents of the use of danthonia in mixtures, claiming, as they do, that it is not as good a fattening-grass as either cocksfoot, rye, and other first-class grasses such as meadow-foxtail and timothy. The supporters of the use of danthonia have, on the other hand, a clinching argument in the fact that danthonia thrives excellently on many soils where the first-class grasses are a few years after a first burn a complete failure. It is still dubious, however, whether danthonia should be included in the initial mixtures for bush-burns where an ordinary rye-grass-cocksfoot mixture succeeds for a few years before running out. Provided danthonia can be easily established just prior to the falling-off of the pasture, either by a second surface-sowing or by heavily stocking with sheep from good danthonia country during the seeding-period of the grass, then it should not be included in the first sowing.

In this way such country might be kept at over a two-sheep standard for some years prior to the introduction of danthonia, and then drop to the ordinary danthonia-carrying capacity of such land without any danger of it turning into fern or manuka. There are, however, such large areas of country in New Zealand where the original surface-sowing has been followed by fern and other objectionable vegetation, that one is inclined to think the effort from the commencement should have been the rapid establishment of danthonia. On very poor country danthonia should never be omitted; in fact, it should be included in considerably larger amounts than at present, though, of course, the high price is a drawback in this particular. *Danthonia semiannularis* is not now so extensively used as it was a few years back. On poor country where periodical burning to kill out manuka is necessary it is perhaps better to sow *semiannularis* than *pilosa*. It is said that the former carries a fire better than the latter, but the superiority of *pilosa* from a grazing point of view makes it uncertain whether *pilosa* should not always be sown in preference to *semiannularis*.

REDUCTION IN FIORIN.

Fiorin and other members of the *Agrostis* family no longer occupy the position in grass-seed mixtures which they did formerly.

This is not due to their failure to establish or remain permanent, but to a widespread apprehension of the fact that their feeding-value in practice is extremely poor. There are at the present time wide areas of surface-sown country largely composed of these grasses, a sure indication of paucity of lime in the ground. It is, of course, quite certain that such land by liming would be greatly improved, but in many cases the broken nature of the country prohibits any efforts in this direction. Fiorin and most of its near relatives have the great objection of crowding out the majority of other grasses and becoming sod-bound, with the result that the herbage produced, apart from being of poor feeding-value, is scanty. On very poor land fiorin (and under this name red-top is also included) is still used, but its value even there is doubtful. During recent years a closely allied species known as Waipu brown-top, a form of *Agrostis canina* and produced in the North Auckland district, has sprung into prominence. Unlike the ordinary forms of fiorin, its herbage is readily eaten, and it combines much better with other grasses, not being so prone to overrun others or become sod-bound. Its use, however, is limited to the northern part of the North Island, and the price is very high considering the amount of husk present in every line.

DEVELOPMENT OF THE PASPALUM ZONE.

A grass of quite recent utilization in bush-burn mixtures is paspalum. Its use is restricted almost entirely to the Auckland Province, and in the northern peninsula to-day it can be looked upon as almost the dominant grass over large areas. It is generally sown in quite small quantities, from ½ lb. to 2 lb. per acre, and, provided the seed is of good quality, it can be established in autumn sowings quite easily in the North Auckland district. The term "paspalum zone" may be given to this area to distinguish it from those other regions of New Zealand where paspalum can only be readily established when spring-sown, and therefore does not enter into bush-burn mixtures. Recent investigations have shown that autumn establishment of paspalum can be successfully carried out farther south than was previously thought practicable, the seed remaining dormant till the following summer, when germination takes place. Much has been said both in favour and the reverse with regard to this grass, but I do not wish to discuss here either its merits or defects. It is sufficient to say that in its own particular region paspalum marks the most important development so far as grasses alone are concerned that has occurred during the period under review. In

passing, it may be well to remark that in certain parts of New Zealand this grass is probably destined to play an important part in the subjection of blackberry on rough hilly country. Sown after firing the blackberry it stands repeated burning with impunity, resembling danthonia in this respect. Many areas on the Coromandel Peninsula have been treated in a very fairly successful manner in this way.

Irrespective of the value of paspalum, it will, so far as bush-burns are concerned, always be restricted more or less to its present zone. On the other hand, it is quite likely that over a considerable area of the North Island where summer droughts interfere with grass-production paspalum under special management will be used as a permanent summer grass-forage crop. Its tolerance of drought and great yield during that period when pastures are at their barest admirably fits it for that purpose, and it is more than possible that it will finally supplement, if not supersede, certain annual forage crops on dairy farms.

USE OF EXPENSIVE SEED.

It is often asserted—and this is particularly true of American text-books — that the first essential of any extensively used grass is that the seed must be cheap. Without doubt this contention was the main reason why excessive amounts of rye-grass were until a comparatively few years ago included in nearly all bush-burn mixtures. The same idea was no doubt the reason also why Yorkshire fog was so regularly used on much good land in the early days. The past twenty years has, however, completely altered this view. The actual practical value and suitability of the grass for the purpose required are the points that to a large extent determine whether any particular grass should be used, price being in most cases a secondary consideration. This has led to a great increase in the use of certain normally high-priced seeds, and is particularly true of meadow-foxtail, *Poa trivialis*, and danthonia. The increase in the use of meadow-foxtail is, indeed, remarkable when one considers that the retail price is rarely under 2s. per pound and frequently exceeds that figure. Danthonia, again, at over 1s. per pound is freely used to-day on land where twenty years ago screenings and refuse would have been the only material sown. Timothy affords another case which well illustrates how little importance is now given to price in comparison with the determination to use the most suitable and profitable grasses. This grass, considering the number of seeds per pound (over one million) and its high average germination,

is, with the exception of Yorkshire fog, the cheapest on the market. The cheapness of the seed, however, has had no influence on any increase in its use, and to-day less timothy is grown than was the custom twenty years ago, although on land suited to its growth it is, of course, still always included in mixtures.

ABANDONMENT OF RUBBISH.

Coincident with the determination to use the most suitable grasses in mixtures, irrespective to a large extent of price, there has developed perhaps the most important change of all in the sowing-down of bush-burns. This is the demand for quality rather than quantity in the purchase of grass-seeds. At the present time high-grade pure seed is demanded even for land of the poorest quality, whereas it is only a few years ago that the term "suitable for bush-burns" was synonymous with rubbish. "Farmers' dressed" seed was the rule rather than the exception with bush sowings, but experience has brought wisdom, and now the highest type of machine-dressed seed is universally demanded. True, there is a proportion of farmers that still disregard quality in favour of price, but their numbers decrease yearly.

Closely following the demand for clean seed has been the insistence upon good germination, but this is still too often disregarded. Without a knowledge of this all-essential point the quantitative formulation of grass-mixtures must remain more or less a matter of guesswork.

QUEEN-BEE-REARING AT RUAKURA.

THE Apiarist at Ruakura reports that queen-rearing has been carried on through the season and the black-bee element largely banished in favour of the pure Italian. The breeding-queens purchased early in the season have turned out very well indeed. For the sake of experiment, but more particularly to afford the cadets experience, four different accredited systems of queen-rearing have been used—namely, the Stewart, Doolittle, Swarthmore, and Hutchinson. In order to form the nuclei more safely a few were taken to the other end of the farm about a mile away. This also ensured change of rearing and avoided the risk of bees returning to the parent hive. In each case this plan was found beneficial, and when brought back all the queens had been successfully mated, and the nuclei were in first-class condition. Experiments are further being made to mate queens from "baby" nuclei, also from supers with excluders in hives already containing a laying-queen, after the manner advocated by Doolittle. Results will be available later in the season.

RATS AND THEIR DESTRUCTION.

B. C. ASTON, F.I.C., Chemist to the Department.

THE rat is an animal which has attached itself to man, and by the exercise of a cunning which is truly phenomenal, of a fecundity which is amazing, and of that discretion which is the better part of valour, hitherto has contrived to evade as a race all attempts made to destroy it.

Like most good and bad things, the common Norwegian or brown rat (*Mus norvegicus*)* came, it is said, from the East, invading England in the ships from India in 1732. Lantz says, however, that it reached England about 1728 or 1729. In England it speedily exterminated its congener, the black rat (*Mus rattus*), an animal of similar but weaker characters than those of the brown rat.

Without the aid of man and his ships the rat certainly would never have spread or have become a pest and even a plague in many islands and countries to be only reached by water. Throughout history the rat is found closely but discreetly attaching itself to the highest animal, bound to him by the instinct which tells that food and water may be found near his dwelling. Man, on the other hand, always recognizing the nuisance caused by the voracious appetite and thirsty nature of the rat, has responded by trapping and poisoning, and by encouraging as domestic pets the rat's natural enemies, in a vain endeavour to rid himself of the unbidden guest. The rat is obnoxious to man for many reasons, some of which have become known owing to the recent advances of the medical sciences, parasitology and bacteriology.

Rats will eat almost anything. Grain and seed of all sorts, meat, bones, dairy-produce, eggs and young birds, leather, books, boots, fats, flour, and bran are among the substances constituting their diet. Lastly, they are cannibals of the most depraved kind, devouring their own young, the less powerful of other kinds of rats, and the weak and wounded of their own kind. The loss caused by the depredation of rats is not confined to the food they eat, but extends to the food they spoil and the damage they cause by gnawing through such structures as wooden partitions in search of food and water. A consignment of apples

* "Brown Rat," in the United States Biological Survey Bulletin No. 33, 1909.

recently arrived in New Zealand with a hole drilled through each apple, presumably through rats searching for the pips, of which they are fond. Rats will tunnel through wood, brick, or, it is reported, even concrete, and frequently damage drain and water pipes. In addition, they will damage valuable fabrics, such as those of wool, silk, and fur stored in warehouses, when they are collecting material with which to line their nests. Gardeners complain of the damage to their flowers and bulbs; insurance companies tell of fires caused by rats gnawing wax matches and carrying oily rags, which subsequently spontaneously ignite in places difficult to gain access to. Rats often damage the insulating-material of telephones and electric-light wires, and sometimes cause fires in this way.

The actual damage to property caused by rats appears endurable when compared with the horrible diseases which they assist in spreading through the human race. The bubonic plague, or black death, is the most dreaded of these. The rat, which has been suspected for the last three thousand years of being concerned in the spread of the plague, is definitely found guilty by modern science of acting as host of the plague-flea, and so distributing the germs known as *Bacillus pestis bubonicae.* Trichinosis, a disease of the pig communicable to man and the rat, has been proved to have been spread by rats. *Trichina spiralis* is a minute parasitic nematoid inhabiting the flesh and intestines of animals. Three per cent. of the rats killed on one occasion at the Glasgow abattoirs were found to be infected by trichinae, and it is noteworthy that epidemics of trichinosis only occur where the brown rat is found. The wholesale destruction of rats in the case of these epidemics is therefore considered by health authorities as the first essential in stopping the spread of the disease. Rats also occasionally suffer from rabies and a leprosy-like disease. Again, they have been accused of spreading horse-influenza among the horses used in coal-mines. Lantz further suggests that septic pneumonia may arise through the bodies of dead rats decaying in wells used for supplying drinking-water. Ptomaines may also be conveyed to meats, and the germs of typhoid, scarlet and malarial fevers, diphtheria, &c., may be brought from drains to places where they may threaten human health.

The rat is an animal chiefly of nocturnal habits, eminently adapted to succeed in any environment by reason of its great strength and well-developed faculties. It can not only gnaw, burrow, run, jump, climb, and swim, but it can transport breakable articles like eggs over considerable distances and over what might be considered inconceivable obstacles. American official re-

ports* prove that the brown rat can swim for an hour and a half in the sea, will jump upwards and outwards 17 in., will climb pipes and wires, passing from building to building on the wires, and may jump as much as 2 ft. laterally. Placed in a stockade with firm soil, surrounded with galvanized iron sunk in the ground 3 ft., the brown rat will commence to burrow at once, and in forty-eight hours the burrows are found to extend downwards 2½ ft. circling the stockade. From feeding experiments with wild rats and other information Boelter† came to the conclusion that the economic damage to food and material caused by rats was at least ¼d. per head per day, which, when the approximate number of rats (400,000,000) in Great Britain is taken into consideration, points to a loss in that country from this cause of at least £15,000,000 annually. This estimate has been accepted by Sir James Crichton-Browne, F.R.S., president of the English Incorporated Society for the Destruction of Vermin.

Little can be said in favour of the rat. To some extent it acts as a scavenger, but modern methods of disposing of town refuse have reduced the utility of rats to a minimum. Once, indeed, when Paris was besieged by the Germans a fine sewer-rat was accounted a delicacy as human food, and one English authority goes so far as to think that there is no consistency in eating rabbits and refusing rats. In England, however, to say the least of it, rats as food have never been popular.

The English Society for the Destruction of Vermin has offered a prize of ten guineas for the best suggestion of utilizing rats or their skins, but without apparent result. Rat-gnawn ivory is, however, selected by the turner who makes ivory-ware, he well knowing that the rat always selects that portion of the elephant-tusk which contains most animal matter in preference to that containing most mineral matter, and that the former from its elasticity and transparency is a better quality for his purpose.

METHODS OF COPING WITH RATS.

We have reached a stage at which, knowing something of the history and habits of the brown rat, we may proceed to consider the best means of coping with the pest under the following heads :—

Preventive means : (1) rat-proof construction ; (2) adequate protection of water and food.

Curative means : (1) frightening ; (2) destructive—(*a*) natural enemies, (*b*) traps, (*c*) poisons.

* R. H. Creel, United States Public Health Reports, 28/2/13, p. 382.

† "The Rat Problem." W. L. Boelter. 1909.

PREVENTIVE MEANS.

Portland cement is now such a universal material of construction, whether alone or reinforced with iron, or mixed with stone and sand as concrete, that little that is new to the reader can be said in support of the use of it. Many kinds of structures formerly made of wood are now made with the aid of Portland cement, and when buildings are efficiently constructed with concrete foundation an effectual barrier to the ingress of rats is imposed. The screening of basement windows with wire netting, the furnishing of all drainpipes with traps and gratings, and the elimination of all means by which rats can climb and obtain access to buildings must be accomplished if the cunning animal is to be baffled.

Keeping anything which may serve as food for rats in rat-proof receptacles, or hanging it out of reach in such a way that rats cannot jump or climb on to it, is one of the surest ways of discouraging their presence in buildings. All offal and refuse should be kept in covered metal vessels and disposed of at short intervals. Scraps of food should never be thrown about, but always carefully collected and destroyed. The rat is a very thirsty animal and cannot long live without water. From experiments conducted by the United States public health officials it was found that rats in the majority of cases live only from three to fifteen days on wheat without water, but with foods containing much water, such as carrots, the animals were alive thirty days after the experiments began.* This necessity to rats of water or watery foods may be made one of the guiding principles in maintaining free from rats warehouses containing food.

CURATIVE MEASURES.

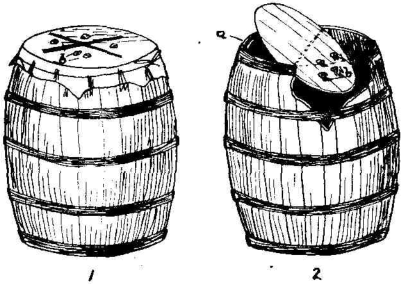
A rat is not easily frightened, but under some circumstances it may be desirable to place in its runs or burrows one of the following substances: Freshly slaked lime—dry or as a thin whitewash; a strong solution of ferrous sulphate (copperas); chloride of lime; gas-tar; powdered red pepper; or caustic potash.

The natural enemies of rats may be well employed in the general crusade against the vermin. In New Zealand hawks and owls perhaps do some good, and it would be interesting to learn how far the introduced stoats and weasels will forsake birds and rabbits in order to prey upon the more dangerous and perhaps less toothsome rat. The introduction of the mongoose into Jamaica to kill rats which infested the sugar-cane was fraught with evil

* United States Public Health Reports, 1913, vol. 27, p. 1072.

results, as the rats climbed the canes, making their nests there, where the mongoose could not follow, which then turned its attention to poultry and native birds. Cats and dogs are perhaps the safest natural enemy of the rat. It is noticeable how free some of the Wellington suburbs are from rats, probably owing to the abundance of cats in a semi-feral state.

Traps.—Trapping is a very effective method of reducing the number of rats, but it requires considerable sagacity on the part of the trapper to meet the cunning of the suspicious rat. An adult and experienced rat may require that much thought and patience shall be expended before its capture is effected. Where cage traps are used it may be desirable that the rats should be



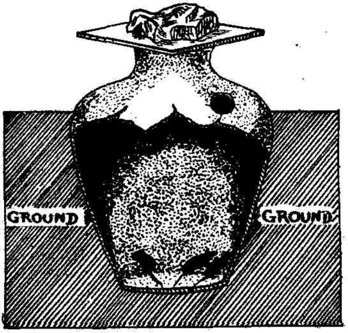
BARREL TRAPS.

1. With stiff paper cover. 2. With hinged cover: (*a*) stop; (*b*) baits. [*After Lantz.*

allowed to walk in and out and take the bait until they are quite accustomed to the trap, which is then set and a rich haul obtained. The same principle may be acted upon in the case of the guillotine or gin trap in exceptional cases, and thus the wisest rat may be taken.

A little space must be devoted to the water-barrel, Burmese, or pit trap, which in good hands is reported as being extraordinarily efficaceous. The principle is much the same in all; the rats are enticed by their favourite food into a large receptacle from which they cannot escape, and their cannibal instincts and ferocity often complete their destruction and save the trapper the trouble of killing them. The barrel trap has a light cover with the bait fastened to it, and hinges on a rod through the

diameter and fitted to turn with the weight of a rat. As an alternative it may be covered with brown paper and the rats accustomed to it by feeding thereon for several nights; afterwards four slits are made in the shape of a cross, and the rats jumping on as usual fall in. A brick standing on end with just enough water to cover it is a modification, the sole surviving rat being found on the brick in the morning. The rat-pit is made by digging a pit 5 ft. deep, allowing the sides to overhang, and then lining the pit with tiles and covering the top with a lattice door. The bait may be chaff on the floor and an earthenware vessel with a very narrow neck containing a small quantity of honey, mutton-fat, or other fragrant stuff. The rats are tempted



A BURMESE TRAP. [*After Lantz.*

to jump down on the chaff, and are then unable to escape. The Burmese trap is a large earthenware jar sunk in the ground, with a weighted cover; on a level with the ground a hole is punched large enough to admit a rat, and some rice is scattered on the floor of the jar, tempting the rodent to jump in.

Poisons. — Rat-poisons may be divided into three classes: (1) Gas poisons, (2) solid poisons, (3) bacterial poisons.

Gas poisons are those intended to be inhaled by the rat, and can, of course, only be used in buildings, ships, or burrows which can be battened down or closed up. The poisonous gases most often used are carbon bisulphide, carbon monoxide, carbon dioxide, sulphur dioxide, and prussic-acid gas. Carbon bisulphide is supplied

as a liquid, the heavy gas formed owing to the evaporation of the liquid speedily finding its way to the lowest portion of the burrows. Carbon monoxide is produced by burning coke or charcoal in a confined space where oxygen is limited in quantity. Carbon dioxide is made by burning carbon in excess of oxygen, but may be usually more advantageously used liquefied as bought in cylinders. Sulphur dioxide is formed by burning sulphur in plenty of air. Prussic-acid gas is formed by the action of sulphuric acid on potassium cyanide. The latter is a very deadly gas, and poisoning by this means should be undertaken only by those skilled in its use, such as nurserymen, vine-growers, and others accustomed to using it.

The solid poisons usually used are barium carbonate, phosphorus paste, strychnine, and arsenic. Barium-carbonate powder is used in the proportion of one-fifth barium carbonate and four-fifths oatmeal or any other convenient meal, the whole being made into a stiff dough with sufficient water. The dough may be put here and there in small quantities in places frequented by rats. It is not harmful to larger animals in the small quantities used to kill rats. Rats killed by this means usually leave the premises before dying, which is an additional advantage. The obvious precaution of accustoming the rats to a non-poisonous dough diet before spreading the poisonous bait may be mentioned. Barium carbonate is without taste or smell, and it is stated by the American authorities quoted to be one of the cheapest and most efficient poisons for rats and mice. White arsenic may be mixed with butter, dripping, lard, or any soft animal fat, and spread on bread, or it may be mixed with sausage-meat. Rats are said to be able to stand large doses; nevertheless, it may serve the purpose of frightening them away. Phosphorus paste, a mixture of fat and phosphorus made up by druggists, is a favourite poison for rats, but the danger of fire arising from imperfectly mixed globules of phosphorus in this paste has been pointed out. There are in New Zealand, however, hundreds of men accustomed to handling phosphorus in poisoning rabbits, whose local advice could be taken as to the safest means of utilizing this poison.* Strychnine is expensive, and the animals

* A simple and effective method of using phosphorus as the poisoning agent is as follows: *Fill the bowl of a soup-plate with pollard-dough of a consistency* usual for rabbit-poison, mixing in sugar and a little salt. Spread level and put a fairly large piece of dripping on top. Heat in an oven until the dripping has melted and covered the whole of the pollard. Let stand till cold and firm, and place where accessible to rats. They will cut a small hole in the dripping and eat out the pollard. Miss a night, then repeat the process, but this time using phosphorized pollard. The rats will again cut the dripping and take the pollard—*with results disastrous to themselves.*

die in a few minutes, allowing them little opportunity to leave the premises, as they would if time permitted, to search for water. Their dead bodies thus cause a nuisance in inaccessible places in buildings. Powdered strychnine may be mixed with meat, sausage, toasted cheese, &c., or mixed into a syrup with sugar, water, and oatmeal in the proportions of half an ounce strychnine, one pint of thick syrup and oatmeal mixed in to thicken into a dough. Extreme care must be taken in handling and in leaving about strychnine, arsenic, or phosphorus paste, as domestic birds and animals may easily become victims.

The last form of poisoning is that of spreading disease among rats by means of prepared bacterial cultures. As some of these preparations have been highly commended, there is no reason why they should not be tried under suitable supervision if they are now obtainable. It is claimed they are entirely innocuous to all domestic animals, and excellent results are reported to have been obtained by their use.

SUMMARY.

No word can reasonably be urged against the extermination of rats in any community. Both on economic and on health grounds there are the strongest reasons for taking concerted action in destroying rats wherever they may be found. Without concerted action by the whole community rats in one area are likely to migrate to another, and so escape. The methods of destroying rats by trapping, poisoning, and by natural enemies have been briefly outlined in the preceding matter, but there are one or two other ways in which the work may be hastened. One of these is by municipal action being taken in paying a small sum — one or two pence — for the dead bodies of rats. Legislation compelling public bodies to take the necessary steps for the destruction of rats could be passed also, enacting such measures necessary to prevent fresh colonies of rats being landed by visiting vessels, and voting the necessary money for the purpose of carrying out the provisions of the Act.

Messrs. Donald and Sons, of Masterton, write drawing attention to an advantageous method of picking apples growing beyond ordinary reach, which is followed by some of the Wairarapa orchardists. This is simply to use a suitable length of tin downpipe, pushing it round the fruit, which readily becomes detached and gently rolls down the tube into the picker's hand without bruising.

VETERINARY AND MEDICAL SCIENCE.

A. M. PATERSON, M.R.C.V.S., Veterinarian.

To many people in New Zealand the word "veterinary" must have very little if any significance, as it is to be seen on many blacksmiths' and chemists' signs, where it has no meaning at all. Moreover, as the word "vet.," which is the abbreviation for "veterinarian" or "veterinary surgeon," is used by many grooms, blacksmiths, trainers, horse-breakers, and others throughout the length and breadth of the land, the meaning of the word "veterinary" is still further obscured.

Properly used, the title "veterinary surgeon," like the title "doctor," has to be earned by a long and costly course of assiduous study, and by a demonstration of efficient knowledge in many branches of science; and only those who have undergone such training, exhibited this knowledge, and given ample evidence of their ability to treat diseases in the lower animals according to the best-known methods of science, have a moral right to use the word "veterinary."

The veterinary profession is closely allied to the medical profession. Both the doctor and the veterinarian apply a knowledge of anatomy, physiology, pathology, chemistry, and bacteriology to the prevention and treatment of disease. The medical man applies his knowledge to diseases which attack human beings; the veterinarian applies his to the diseases affecting the lower animals. In many cases human and animal diseases are very similar, and are curable by the same remedies; while in some instances the diseases are intercommunicable—that is, they may be transmitted from men to animals, or from animals to men.

It will be readily understood from what has been stated that any advance made in medical science will be reflected in veterinary science, and *vice versa*. During the past hundred years both of these branches of science have made marvellous progress; and nowhere is this progress better illustrated than in the mastery both have gained over contagious diseases that in bygone times decimated whole communities periodically, destroying men and animals by the thousand. With a fuller understanding of chemistry, and a more accurate knowledge of the mechanism of the body, a good foundation was laid for a clearer comprehension of what diseases really are. Having become familiar with the fact that the bodies

of men and animals alike are built up of minute particles of living matter termed "cells," both professions were able to at once profit by Virchow's theory of cellular pathology. The action of the healthy cells of the various organs and tissues were fairly well understood so long as they continued in healthy action; but when disease affected the body a veil was instantly drawn over what was really known. Virchow's theory, however, shed new light on the subject, and this enabled man to penetrate still deeper into the mystery of disease, and to solve many problems that had hitherto baffled the keenest intellects.

The healthy body was well understood, and the minute changes that took place when disease occurred could now be more or less clearly followed; but it was not yet known—although many shrewd guesses had been made—what caused certain important and widespread diseases. Pasteur's experiments, in France, with diseases of vines led to the foundation of bacteriological science and the enunciation of the germ theory of disease. As the result of Pasteur's pioneer work, disease after disease was proved to be due to the presence and action in the diseased body of living microbes of microscopic dimensions. By various methods of colouring these germs embedded in diseased tissue removed from the body, or contained in discharges therefrom, and placed under the microscope, it became possible to identify them. By these means the germs of anthrax, tuberculosis, tetanus, leprosy, and many others were isolated and studied. The next step was to cultivate the germs in glass tubes partially filled with a sterilized food on which the germs could live. These tubes were placed in incubators, and colonies of the germs grew and became visible to the naked eye. In order to ensure absolute purity the germs thus obtained were, when necessary, cultivated through several generations, and were then used for experiments in inoculation. By these experiments much useful information was obtained, all of which helped to advance the medical and veterinary professions and give them new and more effective weapons for the combating with greater success the various germ-produced diseases.

It is to the science of bacteriology also that we are indebted for the introduction of serums in the prevention and treatment, as well as for the detection, of diseases of this class. Perhaps the best-known serum in human practice is that used in the treatment of diphtheria, and which is termed diphtheria antitoxin. Another serum which is of great interest at the present time is that used in the prevention and cure of tetanus, or lockjaw. As showing its wonderful effects as a preventive, it is necessary only to state that of the thousands of French troops which took part in the Gallipoli expedition not a man contracted lockjaw, although many

other soldiers did. The French soldiers had been rendered immune to the disease by being inoculated with anti-tetanus serum before they embarked for Gallipoli. This serum has been used in the treatment of well-established lockjaw cases in men and animals with gratifying results.

When Pasteur proved that fermentation of vegetable juices was due to the presence of micro-organisms it was suggested to Lister that the suppuration of wounds might also be due to the action of germs. He therefore applied various preparations likely to destroy low organisms, such as microbes, without injuring the tissues they were harbouring in. His efforts, as is well known, were crowned with the completest success, and Lister's system of antiseptic surgery was given to the world. This system revolutionized surgery and sanitary science. In the one case operations can now be successfully performed which had previously ended in failure, and in the other outbreaks of infectious and contagious diseases can be more promptly and thoroughly checked by a better understanding of the objects of disinfection.

Amidst all this new knowledge one thing stood out prominently as an apparently inexplicable problem. It had long been observed that as a disease advanced and overran the system, as an invading army might overrun a country, the vitality of the body appeared to become less and less. When, however, collapse was the most natural thing to expect, there was often an unexpected rallying, a gradual recovery of vitality, a lessening of the viciousness of the invading disease-germs, a steady building-up of physiological strength, and recovery. What caused the patient to rally when he had reached his lowest ebb? What caused the invading enemy to succumb when it appeared to be victorious? These were the questions that long baffled the closest investigators.

It had long been suspected that just as the germs of disease give rise to certain products as the result of their being alive and active, so also did the white corpuscles of the blood, which are in reality not unlike microbes. By the work of Sir Almroth Wright and others these questions have been answered; the obstacle has been removed, and it has been demonstrated that the white corpuscles or other cells do actually give rise to certain products which have a very wonderful and interesting effect on the whole system, on the white corpuscles themselves, and finally on invading microbes. The name "opsonin" was given to these products. It was found that the blood of patients who had recovered from disease contained the largest quantities of these products when the disease had reached its crisis, and it has been proved that these substances were the chief cause in bringing about recovery.

They had the effect, so to speak, of mobilizing the white corpuscles, strengthening them, and making them attack the invading germs, eat them up, and then repair as far as possible the damage done by the enemy. By these means the disease was overcome and health restored at a time when there might have appeared to be no hope whatever.

The discovery of opsonin has been a great boon both to medicine and to surgery, and the work carried on in this new and interesting field of research has been fruitful of many collateral benefits to mankind and the lower animals. The operation of the chief benefit may thus be described: When a patient has reached his lowest state in an attack of disease, and the invading organisms are all but accomplishing a victory for themselves, the practitioner, by promptly applying a method of increasing the quantity of opsonin in the patient's blood may, and often does, avert a fatal termination of the case; and, further, by carefully noting the progress of improvement he succeeds in the apparently most hopeless cases in restoring his patient to perfect health without the aid of a single drug. The method usually adopted for increasing the quantity of opsonin in a patient's blood, or raising the "opsonic index" as it is called, is to inject dead and sterilized germs into the body. Their presence in the system has the effect of stimulating the white corpuscles into greater activity, and to produce greater quantities of the materials called opsonin. This, in turn, causes the white corpuscles to bring about the curative results aimed at.

In the present great war many new discoveries are being made which will greatly benefit the science of medicine and surgery. In the treatment of the most complicated wounds wonderful results are being obtained by the use of new antiseptics. And where these have been employed on the lower animals in this country they have in all cases upheld the reputation they had earned on the battlefield. One is almost safe in predicting for them successful employment in such diseases as contagious abortion, septic inflammation of the womb in the mare after foaling, probably in mammitis, and probably also in foot-rot in sheep.

The veterinary profession in New Zealand is largely organized and controlled by Government. Its function is to do all possible to prevent disease and keep the live-stock of the country in a healthy condition. It also has an important duty to perform in preventing the carcases or products of diseased animals from reaching the market to be sold as human food. By means of the vigilance exercised over tuberculous animals, meat, and milk, a great deal is being done quietly, but steadily and effectively, to check the spreading of tuberculosis among human beings.

The profession is not unaware that were a little more co-operation exercised by the owners of stock many diseases now rampant might be altogether eliminated from the list of national scourges. It is to be hoped that such action will be soon forthcoming, when the organization and united endeavour will be followed by a marked decrease in the number of deaths now annually occurring through the contraction of preventible diseases.

In conclusion, the agricultural and pastoral community should recognize that in order to investigate prevailing diseases, or to carry out the treatment of ordinary diseases of stock, scientific methods must be adopted, and this can only be done by the veterinarian who has been trained on scientific and practical lines, as the day of the empiric has passed.

DYING OF YOUNG FRUIT-TREES.

SOUR-SAP AND ITS ASSOCIATED FUNGI.

R. WATERS, Biology Section.

As a result of the preliminary investigations* into the mortality among young fruit-trees (apples in particular) observed in several parts of the Dominion the following conclusions were reached :—

1. That the condition commonly found in dead or dying young apple-trees and widely known as "sour-sap" is developed almost *entirely upon trees that primarily have been weakened through* various unfavourable physical conditions.

2. That the main cause of debility resulting in sour-sap is that of planting in low-lying positions where the accumulation of surface water unduly limits the soil-aeration essential to healthy growth.

Evidence substantiating this and other minor causes of debility, together with suggestions as to remedial measures, were given by the writer in the *Journal* for February, 1916. This account dealt more particularly with the practical side of the subject. It is now intended to outline briefly the relation of the sour-sap condition to the various fungi appearing in association with that the dition.

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* See *Journal* for December, 1915, and February, 1916.

PARASITIC OR SAPROPHYTIC CHARACTER OF ASSOCIATED FUNGI.

The sour-sap condition in the wood, cambium, and bark of young apples is commonly followed by the appearance of at least six different kinds of fungus fruit, as follows:—

1. Small golden fibrils starting out from the bark and consisting of a gelatinous substance embedding enormous numbers of minute sausage-shaped (allantoid) spores. This is the conidial form of a species of *Valsa*, probably identical with the one shown by Dr. M. E. Cooke, the well-known authority on fungi, to affect injuriously the living bark of apple-trees—namely, *V. ambiens* Fr.—though much more widely known as a saprophyte.

2. Similar fibrils and spores, the former, however, coloured red instead of golden. This belongs to the same genus as No. 1, and was identified for the Department at the Royal Botanic Gardens, Kew, England, as *Valsa Auerswaldii*.

It is noteworthy that the *Valsa* genus includes several species reported on the apple, amongst which are *V. leucostoma* (Pers.) Fr., *V. ambiens* Fr., *V. (Eutypella) prunastri* (Pers.) Fr.

3. Ashy-grey gelatinous fibrils containing large hyaline unseptate spores with granulated contents.

4. Very small black fibrils embedding uniseptate, opaque, olive-green, thick-walled spores.

Nos. 3 and 4 are identified by Kew as *Diplodia* sp., probably *D. Griffoni* Sacc. and Trav.

5. Relatively coarse, white, gelatinous fibrils embedding small hyaline spores, each commonly containing two (but sometimes more) highly refractive bodies like nuclei within its walls. So far this fungus has not been identified.

6. Fusiform spores divided by one or more septæ. These conidiospores arise from bright pink cushions (stromata) which burst their way through the bark from beneath. Kew identifies this as *Fusarium lateritium* Nees.

This latter fungus doubtless occurs on many hosts in New Zealand. I have found it in several places girdling the trunks or branches of tagasaste (*Cytisus proliferus*), causing the death of the parts above. Information has, moreover, been received that it is recorded as a parasite of the mulberry. It is much the commonest fungus appearing upon the bark of young apple-trees previously exhibiting sour-sap conditions, and may occur on apple-trees weakened from other causes than those of excessive soil-water. For some time it was mistaken for apricot coral-spot, so similar was it in outward appearance. This, together with its constant association with sour-sap conditions, has led to

the publication of statements to the effect that the cause of sour-sap is coral-spot (*Nectria cinnabarina*). Certain evidence, however, is now available which further goes to show that it and certain other fungi occur upon the apple saprophytically.

Inoculations.

On the 24th April, 1916, experiments were commenced; they were examined on the 14th December, 1916, with the results recorded:—

1. Ascigerous and conidial spore forms of *Fusarium laeteritium* were laid on the wood, cambium, and bark of a healthy four-year-old Monroe's Favourite apple-tree.

Surface of incision discoloured, but no appreciable extension of this discoloration was found in the adjacent tissues.

2. Conidiospores only of *F. laeteritium* laid in similar positions.

Same results as in No. 1.

3. Fibrils of the unnamed fungus with spores containing two or more luminous globules spread upon the wood, cambium, and bark of Monroe's Favourite.

Wood tissue discoloured to a small depth, and also upward and downward from the incision, making a total length of 3 in.

4. Fibrils of *Valsa Auerswaldii* spread on the wood, cambium, and bark of a Sturmer apple-tree.

No outward sign of the invasion of healthy tissues. The surrounding tissues, however, were not examined internally, as it was desired to allow further time for the fungus to develop.

5. Conidiospores of *F. laeteritium* laid on wood, cambium, and bark of a Sturmer tree.

Same results and treatment as in No. 4.

6. Conidial and ascigerous spore forms of *F. laeteritium* laid on wood, cambium, and bark of a Sturmer tree.

Same result and treatment as in No. 4.

So far these experiments have thrown no doubt upon the conclusions previously arrived at.

Fungi following Root-injury.

Valsa Auerswaldii, a white-tendrilled fungus fruit probably of *Diplodia* and *F. laeteritium*, were found abundantly upon a dead four-year-old apple-tree in one of the fruitgrowing districts visited by the writer. The owner, whose account was borne out by the appearance of the root, stated that this tree was perfectly healthy when it was accidently cut at the main root by the plough, these had then been transplanted whilst in leaf.

Fungi following Fire Injury.

An apple-tree about ten years old in another local district was damaged on the 4th February, 1916, by a gorse-and-grass fire. The trunk all round, the main branches on the windward side only, and the higher horizontal branches and twigs on their lower sides only showed fire-injured bark in which *F. laeteritium* and empty pycnidia, most probably of *Diplodia* and *Valsa*, had burst through the cork layer. Only stems of from one to five years old showed these fructifications, absolutely *none* of which occurred *on* the unburnt sides of the stems. All the leaves had been killed by the heat. On the windward side of the tree six buds had sprouted, all from upper (unburnt) surfaces. On the lee side about fifty buds had sprouted, also from unburnt bark.

Other instances of the appearance of *F. laeteritium* upon fire-injured apple-trees could be cited.

Fungus on Imported Apple-trees.

It is not infrequently found that apple-trees imported from Europe and arriving here in bad condition show the presence of *Valsa ambiens*. The fungus is particularly noticeable upon the extremities of the leaders — *i.e.*, upon those parts which have suffered most from being dried out.

The Question stated.—Various Factors.

The question that now requires to be settled is: Are the fungi in question capable of living only upon previously damaged tissues (saprophytically), or are they capable of attacking healthy tissues (parasitically)? For if the former is the case, then the means of control is to remove the debilitating agents; while if the latter is true, then the fungi themselves must be directly exterminated by spraying or other means.

In the first place it must be recognized that the existence of all fungi is almost entirely dependent upon their surrounding circumstances. A glasshouse, for instance, carefully regulated in respect to ventilation, temperature, atmospheric humidity, &c., is favourable to healthy plant-growth—not because the reproductive bodies of the innumerable disease-producing fungi are necessarily absent, but on account of the conditions being unfavourable to their development. But close up the house and let it sweat, and the conditions are reversed — unfavourable plant conditions, favourable fungus conditions. Again, the parasitic diseases of cereals not every year assume the form of epidemics. Potato-

blight in some seasons is slight in those very localities which in the previous season were devastated. Blue-mould, ripe-rot, &c., bound ahead in packed fruit under certain storage conditions; even *in cool storage certain saprophytic or facultatively saprophytic* fungi find sufficiently favourable conditions for their existence. In fact, whether controllable or not, all the conditions of any position may be regarded individually or collectively as either favouring or opposing each fungus species. The lack of but one essential condition may hinder or even prohibit the establishment of either a desirable plant or undesirable fungus. Similarly, the deadness and the vitality of matter are conditions each of which on the one hand oppose and on the other favour certain *fungi.*

Apart from these conditions there appears inherent in fungi themselves a certain plasticity which, within narrow or wider limits, enables them to adapt themselves to environmental conditions. *"Saprophyte" and "parasite" are terms applied to a fungus to* express its ability to grow upon dead or living matter as the case may be. The inherent adaptability of certain fungi, however, prevents the perfect division of all fungi into two such groups.

Summary.

Returning to the point at issue, it can now be said that—

1. Throughout the apple lands of New Zealand are many small or larger areas in or upon which exist conditions obviously opposing the health of young apple-trees.

2. These areas, particularly where excessive soil-water is the opposing factor, exhibit thousands of instances of the development of sour-sap. *In other words, the opposing conditions are found* reducing the vitality and consequently the chemical composition of the trees from that of full vigour towards that of dead matter. (Numerous examples of the fungi in question are also to be found.)

3. How far this process could advance towards accomplishing the death of the trees (without the aid of a fungus) is in some cases a matter of doubt. It is also uncertain whether the inherent adaptability of any of the associated fungi would enable them to attack sufficiently undamaged tissue to constitute a case of facultative parasitism.

4. It is known, however, that these fungi live and fruit upon dead tissues; in fact, on the apple I have never found their fruit arising from other than dead bark. The inoculations, moreover, as *far as they have gone, afford indirect evidence of the saprophytic*

character of *F. laeteritium*, of the unnamed and rarer fungus species, and of *V. Auerswaldii*. The fire-injured trees provide examples of at least the decided preference of *F. laeteritium* and of *Valsa* and *Diplodia* (most probably) for dead or dying apple-tree tissue; no fungus fruit was found on the unburnt portions of the stems. The imported trees confirm this latter case in so far as *Valsa ambiens* appeared upon the dried terminals. Finally, the occurrence of *F. laeteritium*, *V. Auerswaldii*, and *Diplodia* (probably) upon the tree undoubtedly killed through mechanical injury to the root and transplanting whilst in leaf points strongly to the saprophytic character of these fungi.

5. On the other hand is the case of the parasitic character exhibited by *F. laeteritium* upon tagasaste; the record, moreover, of its occurrence upon the living tissues of the mulberry; and Dr. Cooke's observation concerning *V. ambiens* parasitically attacking the living bark of apples.

Present Conclusions.

Concerning young apple-trees in New Zealand it is therefore concluded that inoculations and further observations show that the fungi associated with sour-sap are commonly saprophytes following upon debility arising out of unfavourable growth conditions. No conclusive evidence, however, is yet available as to whether one or more of such fungi is not also sometimes facultatively parasitic.

TREATMENT.

In practice it is shown that weakness in a plant renders it more liable to fungus attack; in other words, a condition opposing a plant frequently in consequence favours a fungus. Spraying imposes a new condition favouring the plant, inasmuch as it opposes the fungus. Obviously, however, this procedure is quite wrong when it is possible and practicable to remove the condition which necessitated spraying.

I can see no reason to believe that the fungi associated with sour-sap attack young apples regardless of their degree of vitality, and though ordinary routine spraying would reduce the spores of these fungi and consequently their chances of causing infection, yet there seems no reason to especially spray for their control. On the other hand, there is every reason to believe that the removal of the various conditions (particularly that of excessive soil-water) producing debility amongst apple-trees is the surest means of preventing sour-sap—if not, indeed, other fungi to which the apple is susceptible.

ORIGIN OF NURSERY STOCK.

This subject has received the careful attention of a Tasmanian investigator of sour-sap. The conclusions he arrives at are that in Tasmania the trouble occurs almost exclusively on trees imported from Victoria, and that in many cases there are appearances which suggest that infection took place at the time that the trees were budded or grafted in the nurseries. He further states that he has found the disease in many situations where want of drainage could not possibly have been a contributing cause.

Acting on this suggestion, inquiries were made into the origin of affected trees in New Zealand, with the following results: A number of the present owners could not supply the information. Several had affected trees which to their knowledge had been ordered direct from Victoria and Tasmania. By far the greatest number of orchardists had purchased their stock from New Zealand nurserymen; some of the latter, however, had no doubt been obliged to supply imported trees in the seasons when the large demand had depleted their own nurseries. Several orchardists, moreover, had affected trees which they were confident were raised in New Zealand. I am indebted to Mr. I. W. Helmsing, Orchard Instructor, of this Department, for information concerning an orchard in which over fifty sour-sap affected trees were observed in the last three years. The owner of this orchard was also a nurseryman and raised the affected trees from New Zealand material. As mentioned in the February, 1916, *Journal*, the methods of treating material used for the stocks and scions of apple-trees are in some cases such as to produce constitutional weakness. So many of our trees have been imported from Victoria that certainly an appreciable number would be much weakened (if not actually *fungus-infected*), particularly about those dead parts to be found on grafted and sometimes on budded trees near the points of union. Such weakness would, of course, be much more common on badly handled nursery stock.

Whether or not one or more of the fungi in question were imported on weak trees from Victoria it is impossible to say, but in New Zealand the subsequent conditions to which the trees are subjected are shown to be the most fruitful source of injury, and such injury to be manifested by no means exclusively upon the nursery stock from any particular locality.

There seems no doubt that the fungi associated with the sour-sap condition do also appear on trees that have been weakened by other causes than that of excessive soil-water.

OUTDOOR CULTURE OF THE GRAPE-VINE IN NEW ZEALAND.

(Continued.)

S. F. ANDERSON, Vine and Wine Instructor.

PLANTING THE VINES.

THE next operation is the actual planting of the young vines. Prepare the hole for the plant by digging with an ordinary garden spade to the depth of not less than 12 in., and 15 in. square. Then put in the hole sufficient surface soil so that when the vines are planted the union of the graft will be about 2 in. above the level of the ground. Spread out the roots, and shake in amongst them some of the fine surface soil; then half fill the hole with good soil, and press down firmly with the foot; afterwards fill the hole with loose soil. It should be borne in mind that the vine will sink a little when the soil is pressed round the roots, and allowance has to be made for this when placing the vine in the hole. Finally, make a good hill of soil round the graft, to protect it from the sun and drying winds until it becomes well established, as shown in Fig. 5.

Great care is necessary to avoid setting any of the unions too deep. If the unions are placed below the surface of the soil the scion will send out roots; if these roots are not removed they will grow large and take the nourishment coming from the leaves. This will result in the starvation and death of the resistant roots, and in a few years the vines will have no roots but those growing from the scion, and will be as susceptible to injury from phylloxera as if they had never been grafted.

Even if the vines are planted the correct depth they are likely to send out roots from the scion, and also suckers from the stock. Fig. 6 shows a plant doing this. In the autumn following planting level the mound of soil down and carefully cut away any attempt made by the plant at producing suckers or roots.

PRUNING AND TRAINING.

In this article it is not proposed to describe a number of different methods of pruning and training the vine. The varieties that are suitable to our climate and proving profitable to grow

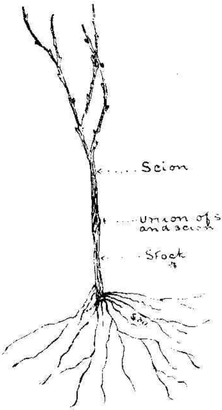


FIG. 4. YOUNG VINE AS RECEIVED FROM NURSERY.

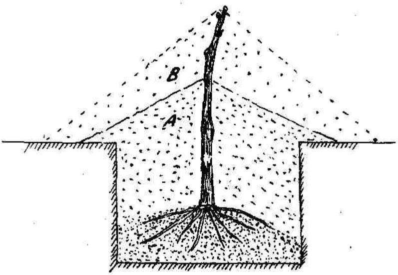


FIG. 5. HOW THE VINE SHOULD BE PLANTED.

A. Hill of soil around plant, covering union. B. Light earthing-up, covering the buds until they start into growth.

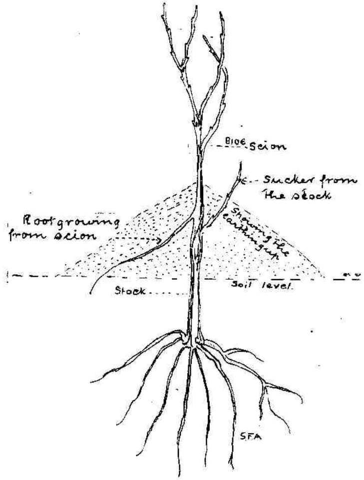


FIG. 6. GRAFTED VINE; FIRST YEAR'S GROWTH.

A sucker has grown from the stock, and the scion has made a root. The earthing-up has now to be levelled down and these growths cut away.

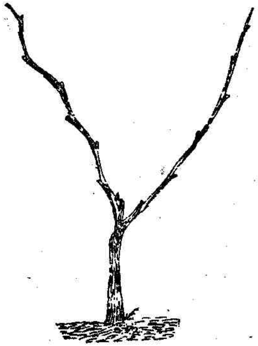


FIG. 7. GROWTH MADE BY THE VINE FROM TWO BUDS.

First year after planting.

are comparatively few in number; and as (with the exception of the American vines) they respond so well to the double Guyot method of pruning it is unnecessary and would only confuse the mind of the beginner to deal with many other methods. A system of training that may be termed the "natural method" will be briefly described, however; also a development of this method called the chaintre system. Both of these methods are suitable for American vines. Any grower who wishes to go further into the matter of pruning and training is advised to obtain Professor A. J. Perkins's book, "Vine-Pruning: its Theory and Practice," published at Adelaide, in which all the different methods are ably set forth.

On planting the young vine it is cut back to the bottom two strong buds. During the following summer, in addition to other shoots that may push forth, fairly strong ones will be produced from the two top buds, which may be termed "leaders," as shown in Fig. 7. Any growth that occurs below these leaders had better be rubbed off. The two leaders are now permitted free growth until winter. They are then cut back (see Fig. 8) to two buds on each—that is, four buds for starting in spring. This finishes the second year's course. The growth in the third spring will now be from four buds, and should produce four strong leaders or canes similar to those in Fig. 9. They will most likely bear a bunch of grapes each. Up to and

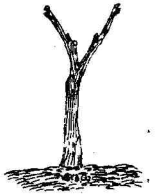


FIG. 8. VINE CUT BACK TO FOUR BUDS, SECOND WINTER AFTER PLANTING.

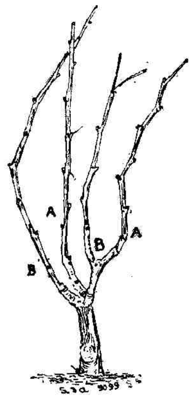


FIG. 9. GROWTH MADE FROM THE FOUR BUDS DURING THE THIRD YEAR.

including this year's management of the vine there should be no restriction of its growth beyond keeping down suckers and any growth below the four leaders.

We now start to prune and train the vine for fruit-bearing. There are four canes or leaders, as shown in Fig. 9, and the lowermost are cut back, or, as it is generally termed, "spurred" back, to a strong bud, each at the base, as shown in Fig. 10. Before doing this, some time during the summer or autumn preceding this stage of the vine's growth, *the espalier trellises, on which to* train and support the vine, will have to be erected. A description of the fence required will be given further on. Returning to the vine that had four strong canes, two of which have been cut back and two fastened down to the bottom wire, it should now be noticed that these canes do not generally start from the same level on the stem. To regulate the height of the stem, the custom when pruning has been to select for the fruiting-rods, for tying down, the best two that are above the others (see A, A,

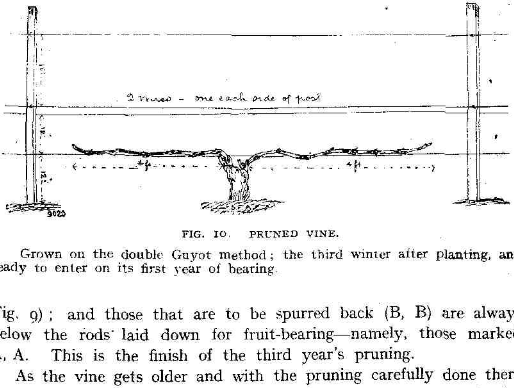


FIG. 10. PRUNED VINE.

Grown on the double Guyot method; the third winter after planting, and ready to enter on its first year of bearing.

Fig. 9); and those that are to be spurred back (B, B) are always below the rods laid down for fruit-bearing—namely, those marked A, A. This is the finish of the third year's pruning.

As the vine gets older and with the pruning carefully done there is generally no difficulty in obtaining the necessary wood for fruiting-rods and for spurring back. It is a wise provision, however, to have a third cane to spur back in case of accident to one of the others.

We will now note the treatment to be given the summer following—that is, entering upon the fourth year. The growth is trained as represented in Fig. 11. The buds on the two spurs send up a strong growth (C, C), and should be allowed to make strong single canes from each and to be confined to them. Any others that may grow from the same spurs must be rubbed off, or, as it is termed, disbudded. As the growth of the selected

canes is vertical, they soon reach the top wire, and are then trained along that wire. These growths must not be stopped—that is, the terminals (D, D) must not be pinched or cut. They will probably branch a little (G, G), and, if so, the branch must be pinched in, otherwise they might take the lead from the main one. For two reasons it is important that the growth of these canes be carefully attended to: first, to provide good strong *fruit-bearing rods, to be brought down to the lower wire in the* winter; and, secondly, to bear the next season's fruit and maintain the vigour of the vine by the foliage they carry. With the exception of *perhaps a bunch or two near the base, these canes* do not bear fruit.

The treatment to be given to the two rods that have been reserved to bear the fruit and fastened to the bottom wire (E, E) will next be described. They may be tied under the wire or twisted round it. In that case the rod coming from the vine next to it, and the one in hand, may be overlapped and the one tie made to fasten both. In the spring every bud along these rods will send out a shoot and have one or two bunches of grapes on it. The shoot from each bud grows upright; although *some may shoot from the underneath side they turn up* and grow very rapidly. When these fruit-bearing shoots are 18 in. to 24 in. long it has been customary to pinch the tops off them. *It is just here that* the plant physiologist differs with the commercial vigneron. Leading viticulturists in Australia condemn severe pinching as harmful—gradually lowering the vigour of the plant. In a general way this must be true of all plants subjected to summer defoliation. In the case of vines grown on the above-described method — training the two canes right and left along the top wire without stopping — the plant must be compensated to a great extent for any stopping of the fruiting-shoots.

In an eighteen-year-old vineyard lately visited by the writer, where this method has been practised from the beginning, the vigour of the vines is as great as ever, showing that where two leading-rods can have unrestricted growth throughout the growing season, and where the fruit-bearing spurs or shoots (see F, F, Fig. 11) are not shortened in to less than ten or twelve leaves, the vine will retain its vigour. It is just here where care is required. A careless person put on to the stopping of the fruit-spurs can do a lot of harm if the growth has been allowed to get a little too far ahead and the foliage has become heavy. It is the custom in some of the vineyards to do this stopping with an ordinary sharp reaping-hook, slashing the tops all to a level just below the top wire. This is rough work, to say the best of it; but much

damage can be done if the rods (D, D in Fig. 11) that are being trained along the top are injured, and unless careful workers are put on the job that is most likely to occur.

Properly and judiciously carried out, stopping may be beneficial in several ways. It is contended that *pinching back the terminals* (and experiments have proved this) causes all the buds remaining *on the rod to become fruit-bearing for the following* season, as is the case in the summer pruning of deciduous trees. Also this terminal pinching, or "topping" as it is usually termed, tends to prevent millerandage, the condition when the berries of the same bunch do not assume an even development, so that at vintage-time the bunches are loosely formed of uneven berries, some scarcely larger than shot.

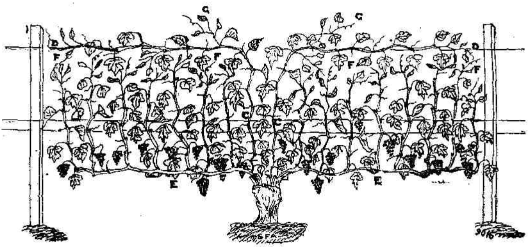


FIG. 11. VINE ENTERING UPON ITS FIRST YEAR OF FRUIT-BEARING, FOLLOWING UP THE PRUNING SHOWN IN FIG. 10.

Topping is also a preventive for non-setting, attributed to an excess of vegetation, which is generally incompatible with abundant fructification. In Montpellier, and in other parts of France, experience has fully proved the efficacy of the above method for preventing non-setting and millerandage. Of course, non-setting is not solely due to excessive vegetation—meteorological conditions may be a cause—but it is given as an example where all climatic conditions for the setting of the fruit have been favourable.

The *after-management of the vine*, so far as the control of growth is concerned, is much on the same lines as that given for the winter pruning at the third winter and the *summer treatment* following that winter. This method applies also to the European varieties of table grapes that are grown outdoors, such as Black Hamburg, Golden Chasselas, Muscat, Hamburg, and others coming within our range of climate. It frequently happens that, owing to

some cause, such as barrenness in the soil, dry situation, naturally weak growth, or through carelessness at the time of topping the fruit-spurs, the canes being trained up to and along the top wire (see C, C, Fig. 11) have not grown sufficiently to make good fruit-bearing wood. In that case the old rod must be retained and pruned or spurred back as shown in Fig. 12. This is termed "spur or cordon pruning," and occurs in Muscat, Hamburg, Cabernet Sauvignon, and sometimes the Pineaux. If it is a well-established vine two shoots may be allowed to grow from each spur, but not more. There is nothing gained by overcropping. With regard to shoots not showing any fruit, this is comparatively rare. The treatment of these shoots should be the same as if carrying fruit. It must be accepted by all plant-growers that pruning debilitates a plant, and the summer stopping very much

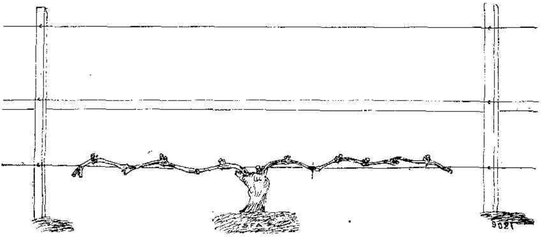


FIG. 12. SPURRED-BACK VINE.

This plant has failed to make strong enough growth to provide new fruiting-rods, and has been spurred back to the old rod to get new fruiting-shoots. See C, C and F, F, Fig. 11.

more so than the winter pruning. It should be the aim of the grower to consider how a shoot can be retained rather than suppressed. These remarks do not apply to the numerous shoots and suckers that are put out at the base of the stem and crown of the vine of some kinds, more especially during the first few years of bearing; but as they are rubbed off soon after appearing, excepting such as are required for replacing others lost by accident or otherwise, no severe check is given. Where a certain amount of defoliating is permissible and a great help in a showery autumn is, just at the ripening-period, by removing the lower leaves so that the fruit can dry quickly. This can do very little harm because these leaves have become tough and dry, and have performed their functions as leaves for the year, or nearly so.

Several photographs of vines at different ages are here given with the object of showing how, by judicious management, the stem is kept low for the purpose of being trained on the espalier fence, the vines retaining their vigour for fruit-bearing year after year. Fig. 13 is a plant of Gros Maroc, a table grape. It has just been planted and pruned, and is a two-year-old. Fig. 14 is a plant of Pineau Meunier about to enter upon its second year after planting, and pruned ready for its third year. Fig. 15 is a three-year-old vine

FIG. 13. NEWLY PLANTED AND PRUNED VINE (GROS MAROC).

FIG. 14. PLANT OF PINEAU MEUNIER ENTERING UPON ITS SECOND YEAR AFTER PLANTING—PRUNED.

of Teinturier, pruned. Fig. 16 is a seven-year-old plant of Black Hamburg, pruned; note the strong canes of this vine. Fig. 17 is a seventeen-year-old vine of Foster's Seedling, an early white table grape; the picture shows the strong-shooting canes, and also the spurs for the production of the fruiting-rods the year following. These five vines are all grown on the double Guyot method. The photos were taken in Mr. B. Steinmetz's vineyard, Greenmeadows, Hawke's Bay.

Fig. 18 represents a four-year-old vine of the American Iona, grown on a bank. It will be noticed that the arms of this vine are being trained close to the ground and supported by forked sticks about 1 ft. high. Fig. 19 is that of another American Iona vine supported on the ordinary espalier fence. This is a wrong method of growing the American class of vine.

Fig. 20 is a nineteen-year-old plant of Pineau Chardonay. It has not been well trained for the chaintre system for which it was intended. The shape, however, does not prevent it bearing an enormous quantity of fruit yearly. This is not an American vine, but it succeeds admirably grown on the chaintre method.

The Natural Method.—For the first two years the treatment of the young vine is similar to that in the double Guyot system. A strong main stem, from 1 ft. to 2 ft. in height, should be developed. The second year's growth, shortened to five buds on each rod is then tied down to stakes projecting 1 ft. out of the ground (Fig. 21). The vine is now ready to enter upon its first year of fruit-bearing, being the third season from planting. As it will have been laid down for future training, the further pruning can be explained better by diagram. Fig. 22 shows the growth that will be made from the five buds left on each rod: A is the permanent rod, B is the growth made from the bud, and C is where the fruit appears at the second joint of the young green wood, the third year after planting.

Fig. 23 shows the vine pruned after its first year of bearing fruit. It will be noticed that the first three shoots from the centre outwards have been pruned to two buds each, and that the fourth and fifth shoots have been shortened to three buds, with the object of extending each rod into two — *i.e.*, branching into two rods. If the area allowed for the growth of the vine be 8 ft. square when these rods have reached this limit, the space allotted will be fully occupied by the fruiting-spurs (as shown in Fig. 24) from the permanent rods. An important point to be considered in this method of growing the vine is the renewal of rods which may be necessary from time to time, owing to different causes, such as the tendency for the fruiting portion to become farther from the main stem each year, a rod dying back, careless pruning, and possibly to fill space. This can generally be done by allowing a shoot to grow from near the centre of the plant, and training it in the place of the old one, as shown by the dotted lines in Fig. 24. This figure shows also how the space can be limited to that area previously mentioned—an important matter in small gardens. The vine is now in its fourth year from being planted. Summer pinching or stopping of the fruit-

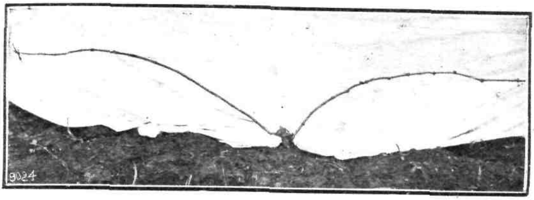


FIG. 15 THREE-YEAR-OLD VINE OF TEINTURIER—PRUNED

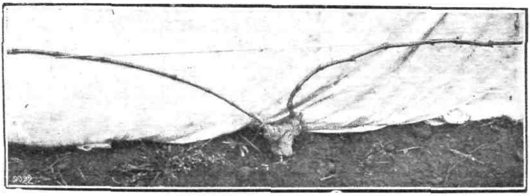


FIG. 16. SEVEN-YEAR-OLD PLANT OF BLACK HAMBURG—PRUNED.

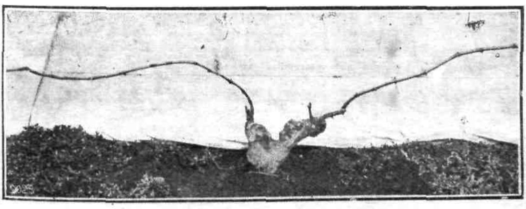


FIG. 17. SEVENTEEN-YEAR-OLD VINE OF FOSTER'S SEEDLING

Stem kept low by judicious pruning, without impairing vigour of plant.

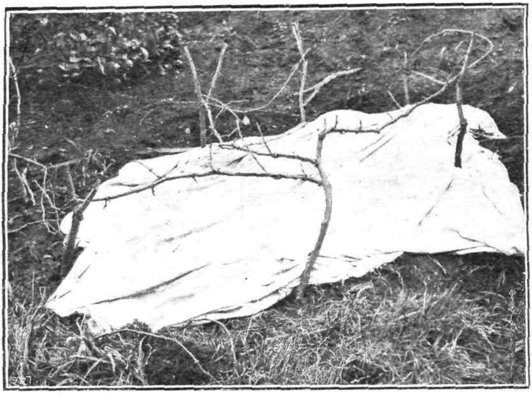


FIG. 18. FOUR-YEAR-OLD IONA (AMERICAN) VINE TRAINED ON A BANK. NATURAL METHOD.

Rods supported by forked sticks.

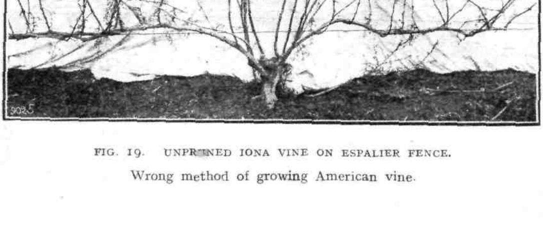


FIG. 19. UNPRUNED IONA VINE ON ESPALIER FENCE.

Wrong method of growing American vine.

bearing shoots in strong-growing vines may require to be done to enable the sun to reach the soil, and assist the radiation of the ground-heat, but in every case at least six leaves should be left beyond the bunches. Too great a suppression of the foliage is likely to delay the development and ripening of the bunches, and decrease the vitality of the plant, making it less disease-resistant.

A thorough cultivation of the soil may be regarded as essential not only to maintain a healthy growth, but also so that the vine may obtain the advantage of that heat radiated from a soil-surface kept free from weeds and grass.

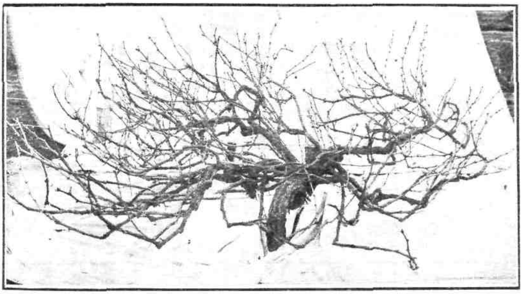


FIG. 20. NINETEEN-YEAR-OLD PLANT OF PINEAU CHARDONAY. (SEE TEXT, P. 206.)

The advantages of growing vines on this method are,—

(1.) The growth of the whole vine spread out near the ground secures the greatest possible amount of sunlight and radiated heat. The climate of New Zealand demands that every advantage be taken of this in order to mature many varieties of outdoor-grown grapes.

(2.) A greater amount of fruit can be obtained from a given area than by the espalier system (Guyot's).

(3.) It is suitable for a small number of vines grown under garden conditions.

The above-described system of training may also be adopted for what are known as the American varieties, such as Isabella, Albany Surprise, &c.; but it must be remembered that this class of vine is much more vigorous in habit than the European varieties, such as Black Hamburg, Golden Chasselas, &c., con-

FIG. 21. NATURAL METHOD OF TRAINING.

Vine shortened to five uds to each rod and tied down.

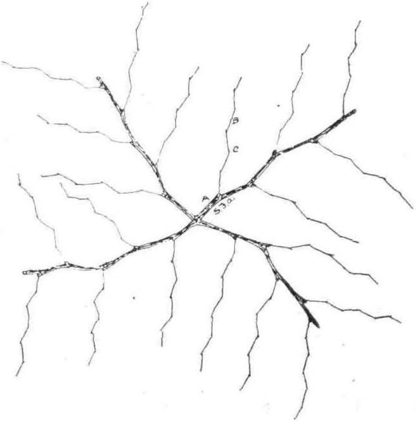


FIG. 22. GROWTH MADE FROM THE FIVE BUDS ON EACH ROD SHOWN IN FIG. 21.

A. Rod. B. Growth made from bud. C. Where fruit comes.

sequently the restricted area, 8 ft. by 8 ft., suggested for the latter varieties must be considerably increased for the former. This is necessary, because the root-growth of the American varieties is extensive and far-reaching, making it necessary to maintain permanent cane-growth in proportion, in order to absorb the free flow of sap that the root will provide. In the cultivation of this class of grape disappointment has followed in some instances, owing to a small yield or actual non-fruiting. This has been due to the lack of sufficient permanent cane-growth, too severe pruning—

FIG. 23. VINE SHOWN IN FIG. 22, AFTER WINTER PRUNING.

The three side shoots A, A, A cut back to two buds; the two end shoots B, B to three buds to become rods.

in fact, an endeavour to keep the American in the same restricted area as is customary and essential in the case of the European varieties.

The Chaintre System.—This method has not yet been practised in New Zealand—that is, not in its entirety. It is particularly adapted to our conditions, because a vine trained over the surface of the ground obtains the greatest amount of sunlight on the foliage and radiated heat from the ground. The reason, perhaps, of the method not having been adopted is that one year longer is required to train the vine to secure the length of stem before

it can be bent over and the over-ground training commenced. To prepare the vine, before the goose-neck form is obtained, will take three years from planting. This treatment consists in growing a rod about 10 ft. long (Fig. 25A). It is necessary, however, that this length of rod be of one year's growth from the start near the ground. To secure this length of ropelike pliant stem the vine, when thoroughly established, must be cut back near the ground and above the graft. It will then in the following season

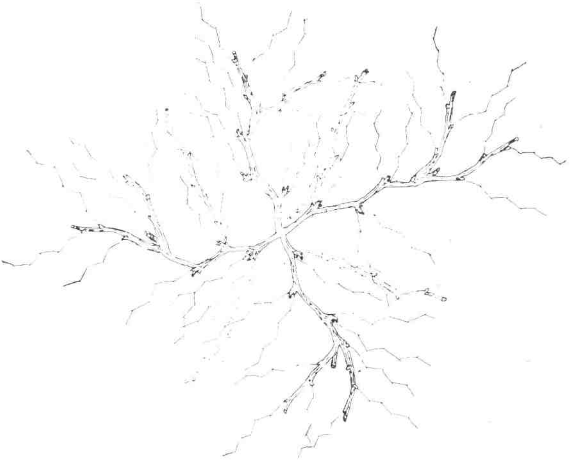


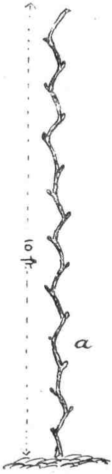
FIG. 24. GROWTH OF SAME VINE AS IN FIG. 23, MADE DURING FOURTH YEAR.

The side shoots of the rods that were pruned back to two buds have now produced a shoot each, doubling the fruit-bearing portion. Dotted lines show how new rods are obtained.

produce the length of stem required provided it is trained on a pole (or a fence) and the laterals kept pinched to prevent the stem branching. When the 10 ft. length of clean stem has been obtained securely fasten it to a strong stake 3 ft. high, and bend over the remainder to the ground, where it may be fastened to a short stake to keep it in its place. The training from this stage will be the same as that described for the natural method. It will be seen from the sketch (Fig. 25B) that the vine trained in this manner can be easily swung

round to permit of the ground being all cultivated. Of course, no growth must be permitted on the stem, nor suckers at the ground-level. The yield from vines grown by this method is very great. They require to be planted 20 ft. apart every way. It is well suited to all the American vines and Pineaux—in fact, all vines, the Black Hamburg in particular; they do not mildew so much as those trained on the espalier system. The preparation of the main stem must be thorough, otherwise the vine will not answer to this treatment.

The great difference between the double Guyot and the natural or the chaintre systems lies in the amount of space required by each. The yield of fruit borne by vines grown on the natural and chaintre methods is very much greater. The reason one or other of the two latter methods must be applied to American vines is that they will not succeed for any length of time on the Guyot system. One condition common to all three systems is that the fruit-bearing rods must be close to the ground, and for the fruit to get the maximum amount of heat the soil



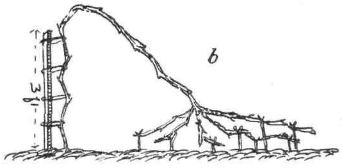


FIG. 25. THE CHAINTRE METHOD OF TRAINING.

A. Rod of one year's growth. B. The goose-neck and fruiting-rods formed.

should be perfectly free of weeds and in a high state of cultivation.

General Hints on Pruning.—Pruning can be commenced as soon as the leaves have fallen. Use good tools, and see that they are sharp. As soon as the axle-pin of the secateurs works loose tighten it up. Get a new pair if the hole for the pin to go through is worn, as the blades then cannot be kept close. The sharp side of the blade should always be toward the vine. Avoid quick, jerky cuts. Do not leave any dead wood on the vine.

In taking off shoots below the soil use a chisel, as the grit will spoil the edge of pruning-tools. Incline the ends of the rods down when tying them to the espalier. Always cut out the unrequired shoots as close as possible to the main stock or rod, so as not to leave any projecting dead wood for the following season. If this is not done the flow of sap is naturally checked to a certain extent, and it is impossible for the wound to heal over. If cut close the wound will heal right over in a year or two, thus ensuring a free and uninterrupted flow of sap. A free circulation of sap is absolutely essential to maintain the vigour of the vine. In every case where possible the secateurs should be held facing or opposite the piece that is to be taken out. This facilitates the cutting and assures the pruner that he is cutting neither too high nor too deep.

Summer Pruning.—This is confined to (1) the rubbing-off of surplus shoots and suckers from the trunk and below the crown where the vine is spurred and fruiting-canes start from; (2) the stopping of fruit-bearing shoots; (3) the pinching-in of the laterals thrown out by the rods being trained along the top wire; in no case should the terminal of these be stopped.

THE ESPALIER TRELLIS.

As espalier fences have to stand for a long time, the work should be well done and the best material used. The strains should not be more than 5 chains long (see plan of vineyard given in last month's *Journal*); longer strains are not convenient for carrying on vineyard work. As these trellises are not required to resist cattle, but merely to carry the weight of the vines, the intermediate posts can be placed, say, 33 ft. apart, with one lighter support between each. The spaces then would be 16½ ft. The end posts or strainers should be picked ordinary 7 ft. 6 in. fencing-posts, 4 ft. in the ground and 3 ft. 6 in. out. They require three holes to be bored, the first 12 in. from the ground, the second 12 in. higher, and the top hole 15 in. above the second; and to be footed and well strutted. The intermediate posts should be fair-sized, 7 ft. long, 4 ft. out of the ground and 3 ft. in. Use No. 8 galvanized fencing-wire, as this resists better than the black wire the action of Bordeaux mixture used for spraying the vines. Four wires are required, the first 12 in. from the ground and the next two 12 in. from that. These two pass through the same hole on each strainer, and can be worked tight on the one roller. The fourth wire is 15 in. from these two—3 in. from the top of the straining-posts. The placing of the wires on the intermediate posts differs slightly. The first wire is stapled 12 in. from the

ground. The next two are stapled one on each side of the post, 12 in. above the first at the same level. This is to provide a space into which to tuck the fruit-bearing shoots as they grow, and to save tying. The fourth wire is stapled 18 in. above the last two. The lighter supports should be 2 in. by 2 in. totara or suitable eucalypt battens. These can be pointed, and driven in with a maul, and the top and bottom wires, but only one of the middle wires, stapled to them in the same way. The top wire from the strainer slopes up the 3 in., but if all the intermediate posts are level this does not spoil a generally neat appearance. For straining

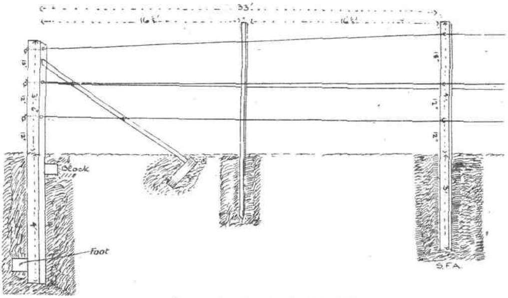


FIG. 26. VINEYARD ESPALIER FENCE.
Showing method of erecting posts and fixing wires.

the wires and maintaining the fence in good order Walker's patent rollers are recommended. The method of anchoring the strainers adopted in some of the vineyards has nothing to recommend it. Such strainers are dangerous, unsightly, and take as long to fix as with a strut. Footing and blocking the posts is where the slight difference in time comes in for fixing, and using the patent rollers makes the cost a little more, but it is a more satisfactory job. Fig. 26 illustrates the method of fixing posts and wires as here recommended.

(To be continued.)

Correction.—In the table published in the last issue of the *Journal* under the heading of Vine-growing and Meteorology the rainfall of Te Mata, Raglan, was unfortunately substituted for that of Te Mata in the Hawke's Bay district. The rainfalls are decidedly different. The West Coast station, partly under the influence of Mount Karioi, has an average fall nearly three times greater than its namesake on the east coast. The mean annual rainfall of Te Mata, Hawke's Bay, is 31·53 in. for twenty-four years, and the mean monthly averages for the first four months of the year are: January, 1·94 in.; February, 2·48 in.; March, 2·95 in.; April, 2·95 in.

FEEDING-OFF ROOT-CROPS IN THE SOUTH.

NEED FOR SUPPLEMENTARY DRY FODDER.

W. J. McCULLOCH, Fields Supervisor, Invercargill.

THE following notes apply more particularly to Southland and other southern districts of the South Island where climatic conditions quite necessitate the provision of winter feed for live-stock. It is very important that the stockowner should intelligently consider the effect on the animal economy of feeding roots solely, and the benefits to be derived by providing a more balanced ration. Without going deeply into a discussion on the albuminoid ratio of various foods, there is quite another phase of the subject that might be profitably studied.

Taking the turnip crop, which is the mainstay for wintering stock in the South, it is observed in many instances that large areas of turnips are fed off without a sufficiency of supplementary dry food, such as hay, straw, or chaff, and sometimes with not even a run-off into a grass-paddock. If at any time stock are shifted from the root crop it is more often because of the waste incurred during wet weather than for the sake of the health of the animals or with a view of more balanced feeding.

The object of the writer is to direct attention to the better balancing of dry matter in proportion to the moisture-content of turnips and similar roots. When we consider the enormous amount of water contained in turnips or mangels it is not surprising that in the southern climate stock take longer to fatten and the mortality rate is higher than in districts farther north, especially when no consideration is given to the provision of a supplementary dry food. The following is the approximate average water-content of our more common fodder crops:—

	Per Cent.		Per Cent.
Turnips	90	Vetches	84
Turnip-tops	88	Clover (green)	81
Swedes	88	Pasture grass	75 to 80
Mangels	88	Clover hay	16
Carrots	87	Grass hay	14
Rape	86	Wheat, barley, or oat straw	14
Cabbage	85		

It will therefore be understood that if stock are fed entirely on turnips they are compelled to take about 9 pounds or pints of water with every pound or pint of dry matter. Thus a sheep consuming, say, 20 lb. of roots daily must take nearly 2 gallons of water with the 2 lb. of dry matter; similarly, a bullock eating 150 lb. of turnips is compelled to take 13½ gallons of water with 15 lb. of dry matter. If we wish to keep a horse in good condition we give it, say, from 20 lb. to 25 lb. of dry food and 40 lb. to 50 lb. of water daily. Is there any wonder that the animal system becomes disorganized when feeding on turnips solely?

This method of feeding is bad enough with a tolerably high winter temperature, but in cold and frosty weather, with the roots almost at freezing-point, it may be imagined what an absorption of animal heat is required by food containing such large proportions of water before it is raised to a digestive temperature. In the case of a sheep consuming 20 lb. of roots the animal system must raise the temperature of 2 gallons of ice-cold water some 40 to 50 degrees before digestion can take place, and this all at the expense of animal heat or previously consumed food.

Many will say that we cannot alter climatic conditions. It is true that the elements cannot be controlled, but we may do much to improve the ill effects of such conditions. At one time Southland was spoken of almost despairingly owing to the wet, cold nature of its climate and soil, but good progressive farming, in the shape of drainage, liming, and cultivation, has mellowed and sweetened the soil to such an extent that in spite of a heavy rainfall the farmer is enabled to work the soil much sooner, and no doubt harvests his crops earlier, than in former times. It is seen, therefore, that the ill effects of a climate can be influenced. Drainage and liming are undoubtedly influencing the general health of stock also, but more could be done by intelligent winter feeding in the direction here dealt with, and much of the difficulty might possibly be overcome by making hay of the surplus pasture in summer.

It is understood that much prejudice exists against attempting such an innovation in Southland as general haymaking, on account of a supposition that the climate is quite impossible for the operation. Surplus pasture is therefore generally allowed to run to waste. It is interesting to note, however, that good-quality hay has been saved in Southland by a number of farmers during the past few seasons. A run-off from the turnip break, with a stack of hay, would greatly militate against the ill effect of such an excess of water forced upon stock by feeding them solely on

turnips, as well as making a profitable use of the summer surplus pasture. This practice would also diminish the consumption of roots, and assist in restoring a proper equilibrium between the dry matter and the water consumed, thus resulting in a more profitable use of root crops.

In the choice of a dry fodder to supplement the feeding of turnips the albuminoid ratio would also be considered, which is a further strong argument why an endeavour should be made to save hay rather than use oat or wheat straw. The following statement of albuminoid ratio will better explain the matter :—

	Albuminoids.		Carbohydrates.
Fattening-bullocks require ..	1	to	9 or 10
Fattening-sheep require ..	1	to	8 or 9
Fattening-pigs require	1	to	7

Now, as turnips contain a ratio or proportion of 1 albuminoids to 32½ carbohydrates, it will readily be seen that in feeding these roots alone a large amount of the carbohydrates is wasted, as it is only in the balanced proportions or ratios mentioned that *albuminoids and carbohydrates can be profitably utilized in the animal system. Therefore in choosing a dry food to better balance* the excessive water-content of the turnips we should also select one that assists to a better balance of the albuminoid ratio.

Without going into the matter of purchasing the more concentrated foods, the farmer has the choice of at least three dry fodders which can be produced on the farm. These are, in order of preference, as follows :—

	Albuminoids.		Carbohydrates.	Total Dry Matter. Per Cent.
Clover hay	1	to	7–9	84
Grass hay	1	to	11	86
Oat straw	1	to	40	86

Clover hay would be preferred on account of its almost perfect albuminoid ratio as well as its large percentage of dry matter. Thus, when fed in addition to turnips it would have the effect of considerably lowering the proportion of water to dry matter as well as assisting towards a better albuminoid ratio. If no *clover hay or grass hay is available as a supplementary food,* then oat straw should be provided *as a last resource*, and although its albuminoid ratio is wider than that of the turnip it would yet have the result of assisting to better balance the dry-matter content.

It is interesting to note how well the live-stock discriminate in their use of any dry fodder provided. A wet or cold day will cause them to eat it in large quantities—showing how well nature teaches the animal what its proper food requirements are. In this connection I would suggest that when stock are feeding off turnips they have free access to hay, for as each constitution differs from another it is reasonable to suppose that each animal will take just what it requires. In the case of hand feeding a wise farmer will so limit the consumption of roots by each animal that the water contained in them approximates to the quantity he could give to an animal eating dry food. Four gallons, or 40 lb., of water per day would be a full allowance for a bullock, and this quantity would be contained in 45 lb. of roots. Probably 50 lb. of roots per day would be a fair average quantity for a full-sized bullock, and a proportionate quantity for a sheep.

Nothing could be more profitable than warm feed in winter for dairy cows, calves, pigs, &c., where such animals are hand-fed. One pound of coal, which costs probably slightly more than half a farthing, contains more carbon than several times its value in food for heating the animal body. Therefore it is more profitable to use coal to heat the food instead of giving the animal extra food. Especially is this true on a bleak winter day when milch-cows are forced to eat turnips with both air and food at a temperature scarcely above freezing-point. The farmer who permits this can know nothing of the heat-forming theory, or he would not willingly waste food in creating an artificial furnace with so costly a combustive element as roots.

SPRAY-TESTING AT ARATAKI.

In the report on spray-testing at Arataki Horticultural Station which appeared in the December issue of the *Journal* mention was made of the use of Cooper's Improved Bordeaux mixture. It has since been recognized that this reference to the preparation in question may have been somewhat misleading. Cooper's Bordeaux is a well-known specific which at full strength has proved quite satisfactory. In the tests referred to, however, it was provisionally used at a reduced strength with the hope of proving its effectiveness at a strength less than that recommended by the vendors, and thereby lessening the cost of spraying. Circumstances then curtailed the experiments, and this mixture was not used at full strength as was intended. Its mention in the published report was not intended by the Manager of the station, as the treatment was incomplete.—*J. A. Campbell, Assistant Director Horticulture Division.*

THE CAROB-TREE.

THE Horticulture Division has received through Mr. W. J. Poynton, of Palmerston North, from a reliable source in Cyprus, several pounds of the seed of the carob or locust tree (*Ceratonia siliqua*), and will be pleased to forward a small quantity to persons desirous of planting in suitable locations.

The carob was dealt with by Mr. J. Beverley, in a note entitled "The Locust-bean," which appeared in the *Journal* for last December. The following contribution by Mr. Poynton affords some additional information on the subject:—

The carob-tree would be of great economic value if successfully introduced into the Dominion. It grows in all countries around the Mediterranean, and would also probably flourish in the warmer parts of New Zealand. The carob is a legume like peas, beans, clover, and lucerne, but in tree form. It grows to about twice the size of a large apple-tree. The wood is highly valued, but it is in the pods that the worth of the tree is found. They are from 6 in. to 8 in. in length and over 1 in. broad. They contain, besides the seeds, a kind of jelly very rich in sugar and proteids. All kinds of stock eat the pods greedily. Working-horses are in some places fed almost exclusively on them, 5 lb. or 6 lb. a day being found sufficient. The pods are dried, and a large trade in them is done by different countries around the Mediterranean. Britain imports them in fairly large quantities. In many places the jelly is much used as human food. The pods and sweet jelly are believed to be the "the locusts and wild honey" of the New Testament. In Majorca and Minorca immense droves of pigs are fed on nothing but acorns and these pods—some of the trees when full-grown bear 8 cwt. or 9 cwt. of pods.

The tree transplants badly, and should therefore be sown where it is intended to grow it. Sow in spring in a sheltered place, in limy or limed soil. Protect from browsing animals while young. If it is necessary to transplant, sow in rough pots and, in order not to disturb the roots, break the pot in the hole made for the young tree. Soak the seeds in hot (not too hot) water for several hours before sowing. The carob is a slow-germinating plant. Some seed sown early last spring at Palmerston North did not appear above ground until the end of January.

LIMING TESTS IN CANTERBURY.

PROGRESS REPORT.

A. McTAGGART, M.S.A., Agriculturist, Fields Division.

In the spring of the season 1915–16 an extensive system of liming experiments was set up in Canterbury by the Department, embracing twenty-two groups of plots each 2½ acres in area. The districts represented in the tests extend from Amuri County in the north to Waimate County in the south, both foothill country and plain being included. Ground burnt lime (from Oamaru) and carbonate of lime (from Waikari) were used, the former at the rates of 1 ton and ½ ton and the latter at the rates of 2 tons and 1 ton per acre.

On the whole, the dry weather experienced throughout Canterbury during the 1915–16 season and during a large portion of the present (1916–17) season greatly interfered with the lime becoming fully available and hence showing its effects to the full.

As might be expected, the foothill country, where more rain occurred and where the soils call more for lime—being sour and for the most part clay loam with a stiffish clay bottom—responded to a greater extent to the lime than did the soils situated on the plains proper. In general, the effects most noticeable in connection with the liming operations were as follows:—

1. On the foothill country all the limed plots showed—

(a.) A marked abundance of red clover and an increased growth of rye-grass, the heavier quantities of both forms of lime having the greatest effect;

(b.) A markedly decreased growth of Yorkshire fog, sweet vernal, and to some extent yellow trefoil;

(c.) Closer pasturing on the part of all stock, revealing an improved palatability in the pastures;

(d.) Where turnips were grown there was a quite noticeable difference for the better in the crop;

(e.) Oats showed an improved crop, especially in the case of the heavier applications, the young crop being of more vigorous growth and much darker in colour. In such oat crops the clover, also, was more abundant.

2. The effects noticeable on the whole in connection with those of the plain-country plots showing results from the liming were—

(*a*.) More red clover, especially from the heavier dressings of both forms.

(*b*.) Less grass-grub (apparently) where this pest was prevalent, the carbonate of lime being seemingly just as effective as the burnt lime in this respect.

(*c*.) Less weeds, to all appearances.

One of the most noticeable features of the experiments on foothill country was the highly satisfactory effect of the heavier application of carbonate of lime. Indeed, in one or two instances the 2 tons per acre of calcium carbonate seemed to produce more red clover than did the other dressings. This all goes to show that, given sufficient moisture, ground limestone is for all practical purposes just as ready in its action as the burnt form.

In connection with the seemingly beneficial effect of liming with respect to the grass-grub, the writer is of opinion that this is due to the lime increasing the clovers—the grass-grub not attacking clovers to any extent, if at all.

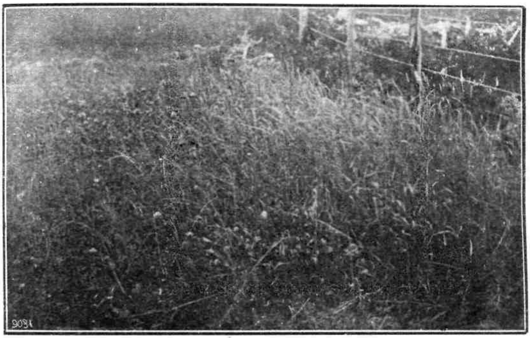
These liming experiments are to be followed up for another year or two, and it is hoped that with the return to Canterbury of normal seasonal rainfalls the effects of the various limings will yet be fully and systematically gauged.

A PAKIHI DEMONSTRATION AREA.

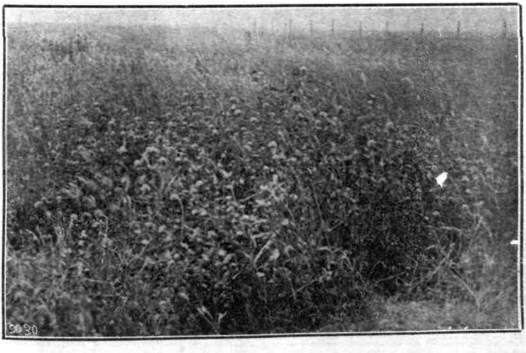
THE photographs on the opposite page were taken last January in the Department's demonstration area on the pakihi lands at Sergeant's Hill (Westport Domain), near Westport. During the last two years this area has been drained, limed, cultivated, and sown down in grasses, clovers, &c., with satisfactory results. A fine growth took place on the area during the past season—as evidenced by the illustrations—in marked contrast to the surrounding waste of virgin pakihi. The past season has been an exceptionally dry one for the West Coast, a condition which very probably suited the cultivated plants by affording an additional corrective to the naturally sour swampy character of the pakihi land.

Spraying experiments at Ruakura on tomatoes with lime-sulphur *versus* Bordeaux mixture show the former to be superior when applied at the strength of 1 in 115.

VIEWS IN PAKIHI DEMONSTRATION AREA, SERGEANT'S HILL, WESTPORT.



ITALIAN RYE-GRASS AND RED CLOVER.



COW-GRASS.

A SPECIAL-PURPOSE DAIRY COW.

"KATE" PRODUCES MILK BUT NOT PROGENY.

W. M. SINGLETON, Assistant Director, Dairy Division.

THE writer has often stated an opinion that many a one-cow herd has a high record. In such cases there is not only evidenced a good dairy strain, but the complement of good attention and kindly treatment is usually present. "Kate," the subject of this note, has responded to such care in a most unusual manner.

Where one cow is kept to supply the family's requirements the customary break in such supply during the usual period of rest and recuperation prior to calving is not looked on with favour, but must be endured with more or less resignation. But in this case, for the last twelve years Kate has provided her owner and his family with a never-failing supply of milk.

Our attention was drawn to this cow's wonderful performance some two years since. Learning that she was sired by a pure-bred Friesian bull, some information was sought from her breeder, Mr. G. Aitchison, of Kaitangata, who also kindly supplied the photograph here reproduced. We are also indebted to the owner, Mr. G. Duncan, of Stirling, for his co-operation.

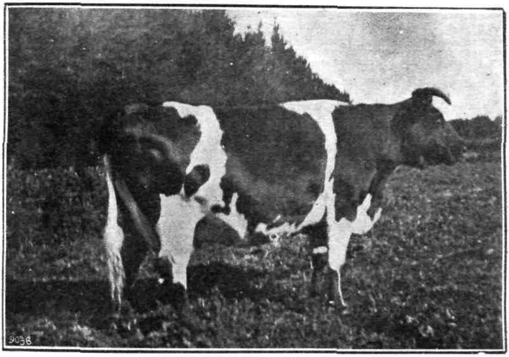
Mr. Aitchison's account is as follows:—

Kate, a grade Friesian cow, was born in the spring of 1898 on Cordyline Farm, Kaitangata, her sire being Netherland Lad. This bull was bred by Mr. Grigg, of Longbeach, and was the sire of some of the heavy-producing dams of my herd. Netherland Lad was by Taureau II—Dam, Marigold (imp.). The dam of Kate was an ordinary crossbred cow of good milking-qualities. During the summer of 1900 Kate, as a two-year-old, gave from 35 lb. to 40 lb. of milk daily. Mr. Duncan bought her when she freshened as a three-year-old. She had a calf the following year, and did not have another calf until a little over two years afterwards. Her last calving was about the beginning of 1905, and she has been milking continuously ever since. At present she is giving about 2½ gallons daily from two milkings. During the last two years she has not milked nearly so well as in previous years, but this is not to be wondered at, considering her age. Previous to the last two years her milk-yield always dropped during the winter months, but she always came into full flow as soon as the summer grass came on.

Although Kate has been without teeth for some years, she is in good condition, and appears equal to some years of usefulness still. It may

be mentioned that she is not speyed, also that if she comes in season she does not give any signs of it. Her sire was doubtless of a deep-milking strain. Had this not been the case Mr. Aitchison's test cows descended from him could not possibly have placed to their credit such high certificate-of-record productions.

It may be accepted that one of the most potent factors in increasing the production of the average herd lies in the prolongation of the milking-period. Only animals of superior dairy



KATE.

temperament can resist the inclination to dry off before a good season's work is accomplished. Kate's performance should impress on dairymen the necessity of infusing into their herds dairy blood of such strains as will cause a continuance of the milking-period for more than the average length of season. The C.O.R. cows with good records on a twelve-month's milking season are the best lines known in New Zealand likely to accomplish such a result.

The Horticultural Overseer at Ruakura states that among the peaches in the farm orchard Mamie Ross, Wiggins, Carman, Lippiatt's Late, Kalamazoo, and Crosby are the varieties that have done exceptionally well this season. This collection of peaches, as past records go to show, can be thoroughly recommended as suitable varieties for any one wishing to plant for a succession of crops. The first-named ripens during the first week in January, and is followed at intervals of from five to eight days by the other varieties in the order mentioned.

WORK FOR THE COMING MONTH.

THE ORCHARD.

J. A. CAMPBELL, Assistant Director, Horticulture Division.

SPRAYING.

THE 1916-17 season, so far as spraying is concerned, is now practically over. In some instances, however, there are orchardists who prefer to spray their late apples for moth during the early part of the month. Under certain conditions this precaution is a wise one, but such conditions apply only to the more northerly localities of the Dominion where continued hot weather often prevails well on into April. In other localities the spraying season generally ends with the month of March, when the spraying outfit is gladly put away for a short spell.

There is, however, a possibility, through the rapid development of brown or ripe rot (*Monilia fructigena*) in respect to pip-fruits, that late spraying in the form of a fungicide may be required in the cooler localities. The necessity for this has not yet been clearly demonstrated, but the probability is that the disease referred to has not yet reached its fullest extent in regard to pip-fruits. At any rate, the extensive spread of brown - rot and the damage it has caused to the stone-fruit crops during the past two or three seasons makes it highly necessary to keep a close watch upon its effect on pip-fruits, particularly late in the season.

With pip-fruits, as with stone-fruits, the damage from brown-rot is not confined to the affected fruit on the tree. The disease is very apt to spread throughout the packed case if affected fruit or fruit-carrying spores of the disease is packed, particularly when packing is done during a period of moist weather. Case-affection is, of course, much more pronounced with soft-fruits, but it also applies to pip-fruits, especially if the fruit in the case is broken or stem-punctured.

The object of applying a late fungicide dressing to pip-fruits is to destroy the spores that may be resting on perfectly sound fruit, and thereby reduce the spread of the disease after packing. When such spraying is necessary lime-sulphur should prove to be

the most useful material for general purposes. If Bordeaux mixture is used it should, for apples, be reduced slightly from the ordinary summer formula, except in the case of hardy varieties such as the Dougherty.

Although spraying is practically over, it would be well, before turning from the question altogether, for every orchardist to take careful stock of his failures and successes in this direction during the season, with the object of profiting thereby in the future. This is a matter which, in order to gain satisfactory results, should be approached with an open mind; prejudice for or against any particular form of treatment is sure to prove harmful in the end. Every orchardist should keep some form of diary in which all spraying data, such as material used, strengths, weather conditions, &c., should be regularly entered up, together with very carefully thought-out deductions as to cause and effect. Such deductions should, if necessary, be amended as experience dictates. Should this be done, information of considerable value to future operations would be added from time to time to the orchardist's store of knowledge on the important question of disease-control.

In reviewing the results of spraying for the year it is always well to remember that a bad workman is always prone to blame his tools. In this respect the unsuccessful orchardist invariably finds more to condemn for his failure in the material he has been using, weather conditions, &c., than he does in his own work and methods. While making full allowance for the former factors in the control of orchard diseases, there is little doubt that in the majority of instances both material and weather conditions are very much overworked scapegoats in accounting for the lack of success, when in reality the correct one more often is the orchardist himself, owing to his lack of resource and energy in the face of difficulties that are other than normal.

HARVESTING THE LATE CROP.

The main work in the orchard for the remainder of the season is, of course, that of gathering, sorting, packing, storing, or disposing of the late varieties of apples and pears. In this connection it is needless to say that the success of the season largely depends upon the manner in which the work is done. The earlier varieties and classes of fruits do not store well, and must therefore be disposed of more or less quickly after harvesting—usually at very moderate prices. This season, owing to light crops being general, was an exception to the rule as far as prices were concerned; but, generally speaking, the orchardist has to look to his later-keeping varieties to return him the major portion of his profits for the year.

All fruit requires careful handling from the time of picking until it is placed on the market—the earlier fruits on account of their being more or less soft and susceptible to bruising, and the later ones owing to the length of time they may have to remain in storage before being marketed. As previously intimated, the latter class of fruit invariably brings a high price when placed, as it usually is, upon a comparatively bare market. Therefore loss of any kind, particularly as a result of rough handling, becomes a more serious matter even than the case with the cheaper though more susceptible varieties.

As far as the general handling of the fruit crop is concerned, growers in those districts where central packing and cool-storage companies are already operating have many advantages over those of districts in which such facilities do not exist. Co-operative companies of this kind are on the increase, and should receive every encouragement, as they are no doubt destined to play a very important part in the future of the New Zealand fruit industry. Not only do the activities of such companies remove from the shoulders of the fruitgrower all trouble as to the provision of fruit-cases, sorting, grading, and packing of his fruit, but also all marketing worries. But their greatest influence for good to the industry will be in establishing and maintaining for their respective districts uniform standards of grade and quality much higher and more reliable than individual efforts could ever hope to attain. This is of the very highest importance, but to be wholly successful such companies must have the co-operation and assistance of all their suppliers, and for the general good of all concerned this should mean every commercial fruitgrower in their respective districts.

In supporting companies of the kind referred to it would be well for growers to remember the old saying "You can't make a silk purse out of a sow's ear." Neither can the manager of a company build up and maintain a reputable name for his company unless he has fruit of high quality to work upon, and the higher the percentage of this class of fruit available the better. As the fruit will be bought wholly on quality in the near future, it is for the grower, both in his own interests as well as for those of his company, to do all that he can to improve the standard of the fruit of his orchard, and, above all things, to deliver his fruit to the packing-house in as perfect a condition as possible.

The main questions to be considered in delivering fruit to the packing-house are the distance the fruit has to be carted, the nature of the roads, and the class of vehicle used. Fruit for

delivery in this way is loosely packed in open cases. The insides of the cases should be even and smooth, preferably padded, but on no account should they be made of rough or broken timber. Neither should light loads be placed on strong-springed vehicles and then taken at a trot over more or less rough roads to the packing-house. The vehicle should be loaded according to the strength of springs with which it is fitted, and taken to the packing-house at a pace likely to cause the least amount of jolting. The object is to land the fruit at its destination minus bruise or stem-puncture, otherwise the packing standard of the company is sure to be detrimentally affected. Stem-punctured fruit is very difficult to entirely sort out of a consignment, but, should it be packed, the small wounds form ideal openings for the entry of *Glomerella* and *Monilia* rots.

POULTRY-KEEPING.

F. C. BROWN, Chief Poultry Instructor.

THE PULLETS AND WINTER EGGS.

If winter eggs are to be secured, April should see all the pullets well settled down into their permanent winter quarters, for it is the pullet that must be chiefly looked to to produce these eggs. With the approach of cooler weather, and the bulk of the old birds undergoing the moulting process, it may be taken for granted that few hens will be profit-makers till the end of winter or early spring. Therefore there should be no delay in getting the pullets placed under the very best conditions possible. To secure a good supply of winter eggs the aim must be to breed birds at such a time and manage them in such a way that they will not go into moult during the pullet stage. For the pullets to commence laying in the month of April they must be hatched neither too early nor too late. Generally speaking, the light breeds should be brought out about the end of September, and the heavier breeds a month later. Hatching the pullets at the desired period, however, does not necessarily mean that winter eggs will be secured: it is only one essential requirement. The subsequent management, especially at the commencement of the laying-period, when everything in nature is against the bird laying, is of equal great importance. The birds should never have the slightest set-back in their whole process of development, and on no account should they be subjected

to a change of quarters or variation of diet when they are on the point of laying or have just started to lay.

The poultryman who succeeds in obtaining a high winter egg-yield leaves nothing to chance. He realizes that winter eggs are an artificial production, and that artificial methods are necessary to secure them. The production of eggs in the spring and summer months, when the hen lays naturally, is a simple matter, but with the laying-pullet it is entirely different. There must be no haphazard methods in the matter of management, or disappointment will be met with just at the time when high-priced eggs are expected. The slightest error made in the handling of the pullet at the laying stage gives the bird a set-back that is not recovered for weeks, and sometimes months. Everything must be done in a proper manner and at the right time. Having the young birds brought up at the right time, the next essential is to see that they are well settled down before they commence to lay. This is not only a prevention of their going into a partial moult with the adult stock, but is the best means of securing eggs in the scarce season. Of course, the too-early-hatched pullet, which has been laying for some time, will generally go into a semi-moult at the time eggs are most desired, apart from any method of management that may be given her. It should not be forgotten, however, that even with these the better the management the shorter will be the time taken to moult and the sooner will the bird commence laying again

The poultry-keeper who has a flock of pullets and is desirous of securing the most profit from them must straight away do several things. He should first of all provide proper quarters, so arranged that fresh air and light are admitted without draughts to all parts of the building. The house should have ample room, not merely enough for the birds to roost in by night, but sufficiently large to accommodate and to provide exercise in comfort for all the birds during unfavourable weather conditions. It is also imperative that the birds be fed under shelter, and not be compelled to wait about in the yard for feeding-time on cold, wet days. Exercise is another important matter that must not be overlooked in maintaining fowls in a healthy state, and the best way of inducing this when the weather is bad is to bed the floor of the house with litter, in which the grain foods should always be scattered. It is only the pullet provided with dry footing, both by day and night, that can possibly give her maximum egg-yield during the winter months.

In order to maintain a heavy supply of eggs in the winter not only is proper housing essential, but good feeding must go

hand-in-hand with it. It only stands to reason that the best layer ever known will not be profitable unless she is supplied with the necessary material from which to produce her artificially induced egg-yield. It is a commonly accepted principle in connection with all classes of live-stock that "half the breeding goes down the throat," and this applies to the laying-hen probably more than in any other case. There is no greater mistake made in the poultry world to-day than to imagine that the heavy layer, when fed on the right class of food, can be overfed and become too fat to lay. If the bird becomes too fat, it indicates she is not a right-type layer, for the bird capable of laying two hundred eggs or over in a year cannot be overfed, even if an ample supply of the right class of food is always before her. Of course, the drone type of bird, or one that has passed its most profitable period of production, will become too fat even when fed on the best quality of food. Such birds, however, should not be retained in the flock. They are fat simply because they are not concerned in egg-production. In feeding laying-fowls only sound grains should be supplied, and as much of these given at each meal as the bird will pick up clean. In buying food the best is always the cheapest in the long-run, even if its cost is a little greater. It should be remembered that one egg in winter is worth two in summer, and that any additional cost in securing the winter egg is more than paid back by the increased price obtained for it.

In order to secure a heavy winter-egg yield animal food, such as boiled meat or its substitutes—blood or meat meal—is essential. In the case, however, of pullets coming on to lay, the feeding of these forcing-diets should be introduced gradually, or ovarian trouble will result in consequence. On no account should the pullet be forced to maturity. Generally speaking, a White Leghorn should not commence to lay until about six months old, and the heavier breeds at seven months. A good supply of green food is also necessary for the maintenance of healthy and vigorous stock, to say nothing of the rich yolk-colour always to be found when the birds have a plentiful supply of the right class of green material. As a green food there is nothing better than chaffed lucerne clover or watercress. Of course, sharp gravel, grit, crushed oyster-shell, and clean water should always be available to the birds. Cleanliness is another thing which must be strictly enforced if the birds are to be kept in a healthy thriving state. The pullets cannot be expected to lay to the best advantage if their only opportunity is to exercise in dirty, vermin-infested quarters.

THE MOULTING-PERIOD.

Now that the mature hens are undergoing the moulting process they require an amply supply of good food in order to sustain the great strain upon their system. It should be remembered that the producing of feathers is often a greater strain on a bird than the producing of eggs. Especially does this apply to the bird that has just concluded a heavy laying season. The bird must necessarily make her feathers out of the food she consumes, and it is obvious that if she does not get a generous supply her health must become impaired as a consequence. When a bird is moulting she is just in the condition to contract disease, especially such a disease as tuberculosis. It is imperative, therefore, that the birds at this time should be maintained in as good a condition of health as possible. Not only should they be given a plentiful supply of plain nourishing diet, but green food, clean water, and grit are also essentials, while the surroundings should be kept in as sanitary a state as possible. If birds which it is desired to breed from are not done well by during the time they are moulting, it cannot be expected that they will be in the right condition at breeding-time to produce eggs containing strong germs for reproductive purposes. It will generally be found that some flour of sulphur given three times a week, in the proportion of one teaspoonful to each ten birds, mixed in the mash before moistening, will have a beneficial effect during the moulting process. A little boiled linseed given twice a week will also be found most helpful.

THE DEPARTMENT'S POULTRY-STATIONS.

It is gratifying to be able to report that the Department's effort to supply purebred stock and settings of eggs from its Ruakura and Milton Poultry-stations has been well maintained during the past season. The sales were as follows: Milton, 1,333 settings (774 of light and 559 of heavy breeds), 692 birds (455 light, 237 heavy); Ruakura, 1,488 settings (838 light, 650 heavy), 418 birds (231 light, 187 heavy). As a matter of fact, so numerous were the orders for birds of certain breeds that many had to be refused and the money returned. As with birds, so with eggs: many orders could not be executed with the desired promptitude, while a large number could not be filled at all. This applied especially to Ruakura, where the plant was not sufficiently large to meet the demand. An increased number of stock was hatched there last season, however, and additional accommodation is being provided in order that the breeding-pens may be extended during the forthcoming breeding season.

At both the Ruakura and Milton Poultry-stations pullets, cockerels, and ducks for breeding purposes can be supplied from 1st March to 31st July at the following prices: Cockerels and drakes, 7s. 6d. and 10s. per bird, according to selection; pullets and ducks, 10s. each. Coops extra: for one or two birds, 2s.; for every additional bird, 6d. Specially selected birds: Minimum price 15s., including coop. The birds offered at these prices are of the White and Brown Leghorn, Minorca, White Plymouth Rock, and Black Orpington breeds, also Pekin and Indian Runner ducks. All these breeds are being developed from an egg-producing viewpoint, without the size and constitution of the birds being impaired in the process.

THE APIARY.

E. A. EARP, Apiary Instructor.

SUPERS.

ALL extracting-combs should be removed as soon as they are cleaned up by the bees. At this period it is important that the bees be restricted to as small a space as possible. By reducing the size of the hive there is less air-space for the bees to keep warm, and they winter better. It is advisable to leave some supers on the hives where impossible to confine the bees to the brood-chamber. These supers may be dealt with in the spring, when most of the bees will be in one story. A good plan to get the bees to quickly clean up the wet combs in the supers is to place a mat in which is cut a small hole about an inch square between the brood-chamber and super containing the combs. The bees, finding the combs partly cut off by the mat, lose very little time in removing the honey from them. At this operation the excluders should be removed from the hives, except in cases where supers are left on. The excluders may be cleaned and stored away until required again. Remove all bare combs, taking care not to bend the wires. Zinc excluders are readily cleaned by plunging into boiling water.

FOUL-BROOD.

A strict watch should be kept on the brood-combs for symptoms of disease. In case disease is found in a bad form do not attempt to treat the colony, but destroy it. Very little successs will attend treatment at this season, and it is far wiser to postpone it until the spring. Too much caution cannot be exercised in handling

infected colonies in the autumn, as robbing is likely to get started, and disease spread by the robber. If the disease occurs in a mild form, take out the infected combs, and substitute clean drawn-out combs. Mark all diseased colonies for treatment, and carry out all operations with diseased hives as expeditiously as possible. Tinkering with diseased hives in the off season is dangerous, as the beekeeper will find out to his cost.

CARE OF EXTRACTING-COMBS.

If proper care is not to be exercised in storing the extracting-combs when removed to the honey-house it is far better that they *should be stored in the hives*. If the latter plan is adopted the mats must be placed on top of the brood-chamber and the supers tiered above the mats. Unless the apiary is well sheltered, however, they must be weighted, as the winter gales will easily overset them when only empty combs are stored inside. It is far better to remove the combs if it can possibly be done, and thereby obviate the labour of lifting the supers if it becomes necessary to examine the brood-chamber. But in this case the combs must *be properly housed to secure them from destruction by mice and wax-moths*. It is not uncommon to find tiers of extracting-combs destroyed as the result of carelessness. Mice are especially destructive, and the damage they will do in a short period is such as to render the greatest trouble worth while in preventing them from gaining access to the combs. The abnormal price of foundation now ruling is making it far more costly to produce combs, and if large numbers have to be annually produced the renewals become a severe tax on the season's profits.

During extracting many combs may become damaged, but the damage can be repaired by the bees when the combs are returned to the hives. As a rule, however, mice destroy the combs beyond repair, and no effort on the part of the bees can restore them to their original form. It is during the working season that the beekeeper realizes the value of combs in securing a crop. A shortage of combs during the flow will often prevent the bees being kept in working-trim, and the production of honey will be greatly restricted. Mice destroy the combs to gain access to the pollen, and render them foul and offensive to the bees. In the absence of a *mouse-proof room the combs can be stacked in supers tiered one above another*. Be sure that there are no holes or cracks in the supers through which the mice can obtain an entrance. Place a queen-excluder at the bottom of the tier and another on the top. Queen-excluders, if used as described, are a complete success in preventing mice from destroying the combs during the off season.

Should the wax-moth be detected the combs must be fumigated. Bisulphide of carbon is generally used for destroying insect-life, but it should be used with great caution, as it is highly inflammable. It is far better when storing the combs at the end of the season to place a few moth-balls among them. This will usually be sufficient to prevent the attack of the moths.

CARE OF UTENSILS.

As soon as the honey has been disposed of thoroughly clean all utensils used in handling the crop. Remove all traces of honey from the extractor, tanks, uncapping-knives, &c. Wash carefully with boiling water, and dry thoroughly to prevent rusting. The high cost of working-equipment should impel the beekeeper to take great care in storing his plant during the off season. It is advantageous to use loose washing covers of close texture to cover the tanks and extractor. The covers will help to keep the utensils free from dust that is likely to accumulate during the winter. See that all metal parts likely to rust are given a good coating of oil. In season or out of season the watchword of the beekeeper in the extracting-house should be cleanliness.

BOTTOM-BOARDS.

Before finally closing down the hives for winter the bottom-boards require attention. These may be cleaned by scraping. Usually there is an accumulation of pollen, wax particles, and dead bees, and, if left, this material is liable to become mouldy and offensive to the bees. The swiftest plan is to provide a spare bottom-board. *Lift the hive on to a spare one, scrape the old* board, and replace the hive.

MATS.

It is highly important that every hive should be supplied with one or two good mats during the winter months. Mats keep the bees warm, more especially when gable roofs are adopted, and in case of a late examination having to be made this can more readily be done without disturbing the cluster. Not enough attention is paid to the use of mats, both in winter and summer. They are serviceable in both seasons, and the beekeeper would be saved a great deal of trouble if he could be persuaded to place them on all hives. In winter they keep the bees warm, and in the summer prevent the bees from building combs in the roofs. Neglecting their use altogether when using gable roofs is a constant source of trouble, and leads to unnecessary labour in removing the comb which the bees will have built in the roof. There is no

excuse for not using mats, as almost every beekeeper has ample material on hand for making them. Good mats can be made from clean corn-sacks or sugar-bags. They should be cut to exactly fit on top of the frames. A corn-sack will cut up into six mats, and the balance can be used for the smoker. A good plan to adopt in cutting mats is to place a zinc excluder on the material and cut to the same size. Calico mats are useless, providing no warmth, and being readily gnawed by the bees.

THE GARDEN.

W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

THE present is a suitable time to sow turnips for the winter supply. Put in a good breadth, as they remain fit for use for several months. It is wise to sow two kinds of turnips—a white like Early Snowball, which comes in quickly, and a yellow-fleshed variety such as Golden Ball or Orange Jelly; these stand longer before going to seed than the white sorts. Sow cabbage, cauliflower, and lettuce at once. This sowing is to provide the spring and early summer crops, and is one of the most important operations of the year.

Cabbages are divided by seedsmen into several classes, but for practical purposes it is sufficient to recognize two classes only. Early varieties include Flower of the Spring, Ellam's Early, Early York, Early Jersey Wakefield, and a few others. The variety first mentioned is the most popular at present, but all are good. Early varieties grow to a smaller size than do the main-crop sorts, and are planted closer together. It is just as well to sow plenty of seed, so as to make sure of having plenty of plants. As the early cabbages are usually used up quickly, it is as well to sow a larger kind at the same time; the difference of time in their coming in is not great, but is sufficient for the purpose.

It is important that two kinds of cauliflowers be sown, an early and a late variety, as there is a considerable difference in the time the early and the late varieties take to come into use. The best known early kinds are Early London and Snowball. Early Erfurt is not really an early, being little different to Autumn Giant, though a trifle quicker. The early varieties of cauliflower are very prone to button before they have made much growth, and this can only be overcome by encouraging growth in every stage. Seed-beds should be only moderately rich, but must not

be poor. Good loam enriched with bonemeal (2 oz. per square yard) would be better than soil rich in humus, whether it be manure or other substance. The latter class of soil is liable to produce flimsy plants at this time of the year. Young plants should not be crowded. It is best to lift them as soon as they are large enough, and prick them out about 4 in. apart in a plot of good soil. When the plants have grown sufficiently to be planted out, each plant will lift with it a good ball of earth and will begin to grow again a few days after planting.

Thin out spinach that was sown a few weeks back. Mould up celery; pack the soil firmly about the lower part of the stems. Keep the stems well together while moulding up, so as to prevent soil getting to the hearts of the heads. There are several devices for use in the moulding-up; one is a cardboard envelope. A band or two of raffia is useful; the ties may be left on, as they soon decay. A good plan is to use long strips of brown paper 6 in. wide. Wind these round the head and tie securely at the top; some of the leaves must look through at the top. Moulding-up is done as though the heads were not covered, but is carried out much more easily. Cut off asparagus-tops close down to the ground. Rake the soil away from the crowns, and give a good coat of manure; do not replace the soil at this time.

Whenever possible all vacant ground should be trenched. In the bottom of the trench all kinds of garden refuse may be placed, including cabbage-stumps. When this is done a good dressing of lime should be thrown on the refuse. The lime not only acts as a fertilizer, but also prevents occurrence of fungoid diseases.

Onions.—If very large onions are desired the seed must be sown now—from the middle of March to the end of the first week in April is a period that will include most places. The best of the large varieties is Ailsa Craig, and the largest variety the writer has grown is Prizetaker. The seed is to be put in a nurse-bed for transplanting later; it is quite necessary to transplant this class of onion, as, if this is not done, a large percentage go to seed in spring. In districts much subject to onion-mildew it is not a wise plan to rely solely on spring sowing for the smaller keeping-varieties. Autumn-sown onions make their growth early, and so are usually a good size before mildew appears. The treatment that is necessary depends to a large extent on the climate. In places where a wet winter prevails the temperature of the soil falls many degrees below that averaging in a soil where the winter rainfall is light. The soil-temperature is further affected by the amount of drainage, not merely on the immediate spot, but on the land round about. Where such cold-soil conditions prevail there is comparatively sudden change when warm

weather begins. The plants are checked during winter, and with the advent of spring there is a sudden awakening. This sudden change would cause a large number to bolt to seed. My own experience in Hawke's Bay has been that there autumn gradually merges into winter, and spring comes in the same way. The soil has never been very cold, therefore the change is not marked but gradual. I found that autumn-sown onions—of the keeping kinds —did not run to seed. Transplanting in such conditions was not necessary. It is not advisable to give artificial manure of a forcing character to onions until spring. A steady and solid growth is desirable during winter. Give superphosphate or bone-meal, or both, at a rate of 2 oz. per square yard, but avoid nitrate of soda, which is of special value in spring.

Potatoes.—Most crops will now be ready for lifting. Table and seed sizes should be sorted on the ground. The tubers should be dry when carried. They usually keep well in a dry shed; a little air-slaked lime thrown over them is useful in helping to keep the skins dry and hard. Where it is intended to grow a small quantity for early use it is a good plan to select the seed at once, and keep it in some place where it is fully exposed to light and air, but sheltered from rain. Seed taken from a crop not fully matured is best; in fact, this applies to the main crop also. Seed of this character has proved to give better yields than matured tubers.

SMALL FRUITS.

Pruning small-fruit bushes is usually left until the foliage has fallen. To a large extent this is a necessity, but a certain amount of the pruning may be done now to great advantage. Bushes that are very crowded when full of foliage often do not appear so after the foliage has fallen. While the foliage is on is, therefore, the time when a person is best able to judge what cutting-out is necessary. It should be kept in mind that a bush that is crowded must necessarily be carrying a lot of barren wood Only such parts of the bush as get a fair amount of light and air can bear fruit. When the branches are sufficiently thinly arranged so as to admit light to every part, then every part will bear fruit, and only then. In such a condition a gooseberry bush would usually bear more fruit than if it had sufficient branches to create a crowded state, and certainly the fruit would be better in quality. There is also the fact that the fruit would be easily gathered, a very important condition when there are many bushes The thinning-out of branches, as indicated, will have great effect in maturing fruit-buds on the lower part of the branches left this supplies another reason for doing the work at once. Shortening lateral growths must be left till after the foliage has fallen.

Strawberries.—One of the advantages pertaining to the home garden is that its comparatively small size renders it possible to adopt better methods of cultivation than can be applied to large areas; also, a better selection of plants can be made. The work of selection should be attended to at once. In a small plantation only strong plants should be used, because by doing so a good crop should be secured early in the first season. With proper management, and the right variety, fruiting should commence on young beds as early as on older ones. The difference between the young and the old beds should be that while the old produce a greater number of fruits the young beds should produce the finest specimens—at least, this superior quality should be marked in first fruits. Good runners should now be selected and be planted in lines in a plot of good soil. The rows should be just far enough apart to allow hoeing to keep the soil loose and clean; the plants should be 5 in. or 6 in. apart in the rows. For this plan of cultivation I am in favour of spring planting, because it gives opportunity for planting in perfectly clean and well-sweetened soil. The root-system of the plants will be strong, and the plants will scarcely feel the check of transplanting. The best varieties are Madame Melba and Laxton's Noble. In the meantime the plot it is intended to plant the strawberries on should be well trenched. It may be necessary for the purpose of loosening the subsoil, or only for the purpose of trenching in manure. It pays to trench ground even if it is loose. The trenching should be done as soon as possible, so that the soil has plenty of time to settle down. It should be firm when the plants are put out. Planting should be done early in August. About six weeks before planting give a dressing of superphosphate and bonedust, two of the former to one of the latter. Apply from 3 oz. to 4 oz. per square yard, scratching it with a sharp rake.

THE FLOWER-GARDEN.

Seeds of all biennial plants may be sown under glass, as well as many perennials. The sowings may include the various stocks (excepting Ten-week), gaillardias, *Dianthus chinensis*, sweet-williams, aquilegias (of which the long-spurred varieties are the best), *Coreopsis grandiflora*, nemesias, gypsophila, pansies, violas, &c. In the open air quite hardy varieties of annuals may be sown, such as love-in-a-mist, candytuft, streptosolen, linaria, collinsia, &c.

Lawns.—A good lawn is the finest feature of a garden. In some places it is a difficult matter to establish a good lawn, and the difficulty is increased by the rough-and-ready ways frequently adopted. Preparations for making a lawn should be as thorough as for garden cultivation of any other kind, except that trenching,

where it is necessary, need not be so deeply done. If the subsoil is unkind it should be broken up by trenching. Drainpipes should be put in if water holds in the soil. The pipes should be placed at a lower level than the trenching reaches. Drains may be put in as the trenching progresses, thus saving a good deal of labour. If the soil is poor, bonedust or basic slag should be applied on the surface at a rate of 3 oz. of bonedust or 4 oz. basic slag per square yard two or three weeks before sowing the lawn. The surface should be brought to a fine tilth, and be well rolled before sowing, rolling while the surface is dry. Perennial rye-grass should be avoided. The common rye-grass is an abomination on lawns; it usually forms the bulk of the seed in cheap mixtures, which should never be sown. In places subject to frost, however, it may be wise to add some Italian rye-grass to the mixture. This grass grows rapidly, and will shelter the more tender grasses. It will soon die out if seeding is prevented. Sow lawn-grass at the rate of 1 lb. to 6 square yards. The best lawn-grasses for fairly good soil are fine-leaved sheep's fescue (never sow hard fescue), *Poa pratensis*, *Poa nemoralis*, and crested dogstail. In shady places *Poa nemoralis* should predominate, while in damp places *Poa pratensis* does best. On dry and clayey soils fiorin (*Agrostis stolonifera*) seems to be best. In hot and dry places Indian doob-grass (*Cynodon dactylon*) is excellent, but it is difficult to establish this grass. The seed will not germinate until the soil becomes warm, and thus spring sowing is necessary. At the present time an early drought may cause the seed to fail. In other cases autumn sowing is preferable.

Grass might well be more employed in small gardens than it is. Where folks are busy, as is usually the case on small farms, beds and borders become neglected, and frequently couch-grass gets a hold; then the place is never in a pleasing condition. Beds on grass are usually wrong in such places, because beds require special planting to make them presentable. Flowering-shrubs and various small-growing evergreen trees and shrubs always look well on grass, and if the grass is a bit neglected it does not become an eyesore. A narrow border round the boundary of the lawn would afford space for various flowering-plants.

During the exceptionally dry season experienced in the Wellington-West Coast district this year ensilage has proved of the greatest value in feeding the dairy herds at the Weraroa and Moumahaki Experimental Farms. The ensilage at Weraroa was made from a surplus catch-crop of cereals and tares, while lucerne was the material silaged at Moumahaki.

ANSWERS TO CORRESPONDENTS.

In every instance a question to which an answer is desired in the *Journal* must be accompanied by the full name and the postal address of the inquirer, not necessarily for publication, but as a guarantee of good faith. The question should be written on one side of the paper only.

INJURY TO MARE'S HOCK.

"INQUIRER," Hunterville :—

What treatment would you advise for an open sore on the front of a mare's hock? Two years ago she got caught by the leg in a wire fence and sustained the injury now referred to.

The Live-stock Division :—

Injuries to the bend of the hock of such a nature as mentioned in your letter are usually slow in healing, owing to the continual distention of the wound. The usual astringent lotions do not prove satisfactory in these cases, but an ointment, such as zinc ointment, 1 in 8, applied three or four times a day, will be found beneficial. It must be understood, however, that complete recovery will take time.

FORAGE CATCH-CROP.

J. COOKE, Culverden :—

I have a small piece of ground of 7 acres, and have just taken off a crop of oats, and wish to get in a catch-crop for late feed for lambs or breeding-ewes. The ground is good—cleared and drained flax swamp. What is the best purpose to put this to and be in a position to plough again about September?

The Fields Division :—

We would advise you to plough up the land and work it well, and sow Buda kale, 4 lb. or 5 lb. in drills, or 8 lb. to 10 lb. broadcast per acre. This will provide some feed in late autumn and early winter, and can be left for providing further feed in early spring. Buda kale is hardy and will stand the frost well. Seed may be obtained from Christchurch seed firms.

PIPI-SHELLS FOR LIME-CARBONATE.

GEORGE RIDDELL, Kerikeri, Bay of Islands :—

There is a good quantity of pipi-shells on the beaches here. If ground fine enough would they be suitable for the same purpose as ground limestone for top-dressing, &c.? Also, could you advise as to the best plant for grinding or crushing? I have an 8 horse-power oil-engine, so would only require crusher.

The Fields Division :—

Provided the beds of shells are not intermixed to any extent with sand, they should be highly suitable for the production of carbonate of lime for agricultural purposes. The shells contain fully 90 per cent. lime-carbonate, and should grind well. For your requirements a small "Jeffrey Pulver" (John Chambers and Son, Jervois Quay, Wellington, agents) should be suitable. The following are particulars regarding this machine: No. 2 Jeffrey portable crusher with elevator, £187 at Auckland; capacity of 1 ton crushed limestone per hour; power required, at least 12 horse-power. As you will be crushing shells, in all probability 8 horse-power would do the work of crushing without difficulty. We understand that one of these machines is at work, or is to be at work shortly, at Waipu, North Auckland.

GETTING RID OF CONVOLVULUS.

N. H. NORRIS, Hamilton :—

Please tell me how to get rid of convolvulus (Calyxtegia sepium) which has taken firm hold in a vegetable-garden.

The Horticulture Division :—

The most practicable plan is to trench the ground as deeply as possible and place the top spit in the bottom trench. The whole of the deeply buried portions of the plants would die. If a few pieces escape, as probably would happen, they could easily be picked out when first starting to grow. The trenching would do the ground good, so that it should actually be profitable work.

QUARTERS OF COW'S UDDER.

E. J. PEACH, Port Levy :—

Kindly inform me as to which teats I should milk first of a cow that is light in the two front quarters. We have a heifer here that gives three parts of her milk out of the two back quarters. Which teats should I milk first to even the quarters ?

The Live-stock Division :—

It is not uncommon to find many cows which give less milk in the fore quarters than in the hind, and no artificial means have so far been found to increase the natural production of a single quarter. You do not mention whether you consider the two front quarters are affected with any complaint such as contagious mammitis, but if in doubt we would advise you to send a sample of the milk to the Officer in Charge, Government Laboratory, Wallaceville, who would make a microscopic examination of the same, and advise you accordingly.

CAULIFLOWER-SEED.—LADYBIRDS AND SPRAYING.

F. S. MACKIE, Mount Barker, Western Australia :—

In May, 1915, I planted some cauliflower-seed, which in due course produced plants. One of these I allowed to go to seed and collected the seed. The plants now growing from this seed show signs of being cabbages. Can you please inform me how cauliflower-seed can be made to produce the same vegetable ?

2. In spraying fruit-trees all insects are expected to be killed. Can you suggest any means for the protection of ladybirds ?

The Horticulture Division :—

1. Cauliflower-seed raised as you suggest will produce cauliflowers, not cabbages, but they may revert back to the cabbage type—that is, if they are raised from inferior plants. "Running out" is the term that is commonly applied in such cases. Probably this is what applies in the case of the seed raised by you. In raising cauliflower-seed select the very best heads. When these run to seed cut away all the lateral seed-bearing growth, retaining only the main crown. Seed raised in this manner will be found to give satisfaction.

2. Unfortunately, there is no known protection to ladybirds in the grub stage, but the adult beetles would be able to escape by making use of their wings. With a winter contact spray no special protection is necessary, as the grub would not hatch out until the summer; but a contact spray applied during the summer would probably kill ladybirds in the grub stage.

DEATH OF CALF.—HEMLOCK.

J. K., Christchurch.

Recently a six-months-old heifer calf of mine died suddenly after having a sort of fit for about half an hour, dancing round and round on its hind legs most furiously, and falling down from time to time, foaming at the mouth and roaring. Neighbours advise me that the plant hemlock, of which there are two or three small tufts in the paddock, was the cause of the trouble. I enclose a sprig of it, and I would be glad to know if you think the plant poisoned the calf. None of the tufts of the plant showed signs of having been eaten by the calf.

The Live-stock Division :—

The plant probably had nothing to do with the animal's death. Calves of this age are liable to pick up any indigestible matter, such as rags, &c., and in all probability something of this kind would be the cause of the trouble. Care should be taken that no paint-pots or scrapings of paint-pots are allowed to lie about the paddocks, as lead-poisoning is accountable for an appreciable mortality of stock in the Dominion each year. A note by the Biologist regarding hemlock and its effect on cattle is appended, as follows :—

The specimen sent is hemlock (*Conium maculatum*). Both leaves and seeds contain considerable amounts of the poisonous alkaloid coniin. There have been numbers of recorded instances where domestic animals, especially cows, have been poisoned through eating the plant. So far as New Zealand is concerned cases of mortality amongst stock have been rare, and appear to occur only when feed is scarce or strange stock are grazing on ground where the weed is abundant. The most prominent symptoms amongst cows are loss of appetite, salivation, bloating, much bodily pain, and loss of muscular power. Hemlock is quite abundant in many parts of New Zealand, and the rare mortality from it shows how strong amongst domestic animals is the instinct of avoiding distinctly poisonous plants.—A. H. C.

THE KUDZU-PLANT.

LYNN R. MCKELVIE, Bull's :—

In an Auckland paper I notice a reference to a fodder plant called kudzu, or *Pueraria Thunbergiana.* Could you give me any information in regard to growing it, and as to whether the climate of this coast would suit; also where seed is procurable, and how much is sown to the acre ?

The Fields Division :—

The kudzu-vine was tried in many localities in New Zealand a few years ago, but the results obtained were very poor. In as far as the experiences of this Department goes it was a failure as a forage plant. It is, of course, possible that the seed used was not of the best, or that the seed of some other strain might have obtained better results. We understand that the plant has been grown by Mr. B. Harrison, Burringbar, New South Wales, who would no doubt be able to give you information as to whether seed can be procured and quantity to sow per acre. Experimenters would be wise to try a small patch before putting in acre lots.

FRUIT VARIETIES FOR HUNTERVILLE DISTRICT.

"INQUIRER," Hunterville :—

Could you please name some varieties of peaches, apricots, and cherries, good for dessert as well as for cooking and preserving, that would do well in the Hunterville district ? The land is hilly, heavy, and inclined to grow rye and crested-dogstail grasses. Would the following pears require any other pear to be grown with them to ensure their being fertilized when in bloom : Williams's Bon Chretien, Winter Cole, and Winter Nelis ? Are the following apples a good combination to grow in an orchard as far as fertilization goes when in bloom : Irish Peach, Devonshire Quarrenden, Cox's Orange Pippin, Alfriston, Jonathan, Ohinemuri, Sturmer, Washington, and Esopus Spitzenberg ?

The Horticulture Division :—

The following varieties are reliable :—Peaches : Early—Sneed, High's Early Canada, Admiral Dewy ; Second Early—Hale's, Wiggins, Mamie Ross, Carman, Delicious ; Late—Hobbs's Late, Lippiatt's Late Red ; James's Cling ; Mid-season—Surecrop, Kalamazoo, Up-to-Date, Kia Ora ; Late Mid-season—Paragon, Muir, Sea Eagle, Wheatland. Apricots : Large Early Red, Moorpark, Oullin's Early, Pineapple. Cherries : Early Purple Guigno, Mayduke, Werder's, Black Tartarian, Florence, Early Lyons. You can safely plant the varieties of apples and pears you mention. There is no conclusive evidence to show that further cross-pollination is necessary

PLANTING WHITE LUPIN.

M. BAN, Te Rapa, Waikato :—

Please inform me what time of the year is best to plant white-lupin seed, and how much seed per acre.

The Fields Division :—

White-lupin seed is best sown in the spring when all danger of frost is past. You will be the best judge of when that period begins to set in. Sow about 1½ bushels per acre (60 lb. per bushel).

MILK FOR PIGS.

A. N., Rangataua :—

Many farmers in this locality make a practice of allowing separator milk to become sour before being fed to the pigs. Is there any advantage in this procedure, or do pigs thrive better when fed on milk fresh and sweet ?

The Live-stock Division :—

Sweet milk is preferable for very young pigs, but with regard to older pigs it makes very little difference whether the milk is sweet or sour.

FERMENTING OF CREAM.

"X. Y. Z.," Dannevirke :—

I have had trouble with my cream lately. After enough cream has accumulated for a churning I stand it on one side to ripen, and the last two lots have apparently fermented and risen up like a sponge set for bread. If stirred up, it would sink to the former level, but after standing a while would rise again. As an experiment we churned the cream, and the butter was eatable, but perhaps not first quality. New cream was always allowed to cool before mixing with the old. Any information would oblige.

The Dairy Division :—

The cause of the cream rising in the manner described is a process of fermentation, which may be expected to develop during warm weather, unless the cream is cooled. If you have a well into which the cream could be lowered, after placing it in a suitable can with a close cover, it would keep in better condition. Each lot of cream should be cooled down separately before mixing, and the cooling should take place as quickly as possible after separation. As an additional precaution all vessels with which the milk and cream come in contact should be thoroughly scalded with boiling water after washing.

Pruning of Tomatoes.—Experiments at Ruakura with tomatoes to determine which system of pruning will give the best results—single or double—favour the latter method, more particularly with the vigorous-growing varieties. These when pruned to the single stems require constant pruning by means of pinching back side shoots forced out by the vigour of the plants. In regard to the quality of the fruit, it might be thought that the single stems would produce the better class. This, however, is not the case, no difference whatever being noticeable. One point in favour of the single-stem system is that the fruit will ripen seven to eight days earlier than on the double-stem method.—T. R. Reech, *Horticultural Overseer*.

BOARD OF AGRICULTURE.

THE Board of Agriculture held a meeting on Thursday, 15th February, 1917, at which a number of matters of public interest were dealt with.

Price of Wheat.—The question of a minimum price of wheat for next year was discussed at some length, and it was agreed to write to the Minister of Agriculture on the subject.

Military Service.—A letter was received from a member of one of the Military Service Boards, stating that a number of farmers who are drawn in the ballot for military service, more especially in the back country, had frequently to dispose of their farms—" in numerous cases they sell at a considerable loss "—and pointing out that there is a danger in these circumstances of aggregation. The opinion was expressed that it would be much more fair to these men if the Government were to purchase their properties for settlement by returned soldiers. The feeling of the Appeal Board in question was that some steps should be taken to find out the minimum number of men required for the agricultural industry, as well as a census of the number available. In connection with this point the Board thought that some special inquiry should be made in the case of the small farmer working his own land without paid help, for in many such cases the income from the farm would be insufficient to pay the cost of hired labour. The Board decided to endorse the suggestions contained in the letter, and to forward it on to the Hon. the Minister of Defence.

Potash-supply.—A long conference with Mr. Aston, Chemist to the Department of Agriculture, took place in connection with some proposals that had been made to the Board regarding the supply of potash. After the matter had been fully discussed it was decided to recommend that the Department should make inquiries as to the practicability of utilizing the wood-ashes from sawmills for manurial purposes; also to ascertain whether anything could be done to obtain potash, iodine, &c., from the seaweeds on the New Zealand coast.

Electricity and Agriculture.—A letter was received from Mr. E. Parry, Chief Electrical Engineer of the Public Works Department, stating that strenuous efforts are being made the world over at the present time to discover new deposits of potash and economic processes for extracting potash from potash-bearing rocks, owing to the cutting-off of the supply of the natural deposit due to the war. Mr. Parry mentioned that a chemical process of treating feldspar was undergoing trial in the United States, and also an electrolytic process for extracting potash out of alunite, and that recently a new electrolytic process for treating feldspar was patented in the United States. As the process was a simple one and capable of demonstration on a small scale, an experiment was carried out in the Dominion Laboratory, the result of which, although not being satisfactory or promising, yet could not be said to be conclusive; and it is hoped to repeat the experiment on a larger scale at Addington, and to conduct other investigations of a similar character at the first opportunity. Mr. Parry further stated that several electro-chemical and electro-metallurgical developments requiring the aid of electricity for their successful pursuit were in view, some of which will no doubt eventuate in course of time, such as the manufacture of nitric acid, caustic soda, hydrochloric acid, grinding phosphate rock and limestone, and converting the rock phosphate to a soluble form, such as the preparation of bicalcic phosphate by the Palmaer process, which depends for its success upon the production of cheap hydrochloric acid by electrolytic means. There should be no difficulty in getting any of these processes into operation now that a supply of electricity is available, provided it can be proved that they are commercially and economically sound.

Fertilizers Act.—The question of requesting manure-vendors to follow the terminology of the Fertilizers Act in all their statements referring to the composition of artificial fertilizers, to which attention had been drawn by the North Canterbury executive of the Farmers' Union, was fully discussed, as was also the question of amending the Fertilizers Act to safeguard the purchaser of fertilizers, and to give full credit to the vendor for the different forms in which phosphoric acid occurs

in fertilizers, in connection with which Mr. W. D. Hunt, a member of the Board, had provided a detailed report. Both matters were fully gone into with Mr. Brown, Director of the Fields Division of the Department of Agriculture, and with Mr. Aston, Chemist, and a committee of the Board was set up to confer with the Department in the matter.

Carriage of Lime.—The Board also considered the regulations in regard to the carriage on the railways of lime for agricultural purposes, in respect of which a report had been drawn up by Mr. Hunt. After a lengthy discussion it was decided to write to the Taranaki executive of the Farmers' Union, asking that body for information as to the cost of sea-borne lime to farmers in its district, so that further representations could be made to the Railway Department on the subject of the concession granted by it in the carriage of agricultural lime.

Noxious Weeds.—With regard to the noxious-weeds question, a further conference with the officers of the Department of Agriculture took place, and a report that had been drawn up by the committee appointed for the purpose of suggesting amendments to the Noxious Weeds Act was read. A lengthy report was also read by Mr. Cockayne, Biologist of the Department, giving a precis of the information contained in the "weed census" that had been received by the Board in reply to its circular asking to be furnished with particulars in regard to the worst weeds in the various centres in the Dominion. Consideration of both reports was adjourned until the next meeting.

Importation of Seeds.—The Board also discussed with the Department's officers the practicability of obtaining legislation at an early date to control the importation of agricultural seeds.

Diseases of Turnips, &c.—The President introduced the subject of club-root disease and its rapid spread, which was a serious menace to the rape and turnip crops of New Zealand, and it was decided to write to the Minister of Agriculture, asking that a special officer be detailed to conduct a full investigation on the incidence of the disease, also to investigate regarding the rotting of turnips in the South Island.

Miscellaneous.—Amongst other matters dealt with were the following: A soil survey of New Zealand; the improvement of handling of fruit on wharves, &c.; the duty on timber imported from British possessions for boxmaking purposes; and the suggested prohibition of the export of white-pine timber.

FORTHCOMING SHOWS.

Matamata A. and P. Association: At Matamata, 21st March.

Temuka and Geraldine A. and P. Association: At Temuka, 22nd March.

Methven A. and P. Association: At Methven, 29th March.

Oxford A. and P. Association: At Oxford, 5th April.

Mackenzie County A. and P. Association: At Fairlie, 9th April.

Malvern A and P. Association: At Malvern, 19th April.

National Patriotic Apple Show, 1917: At Dunedin, 1st to 4th May.

Southland A. and P. Association: Winter Show at Invercargill, 15th to 17th May.

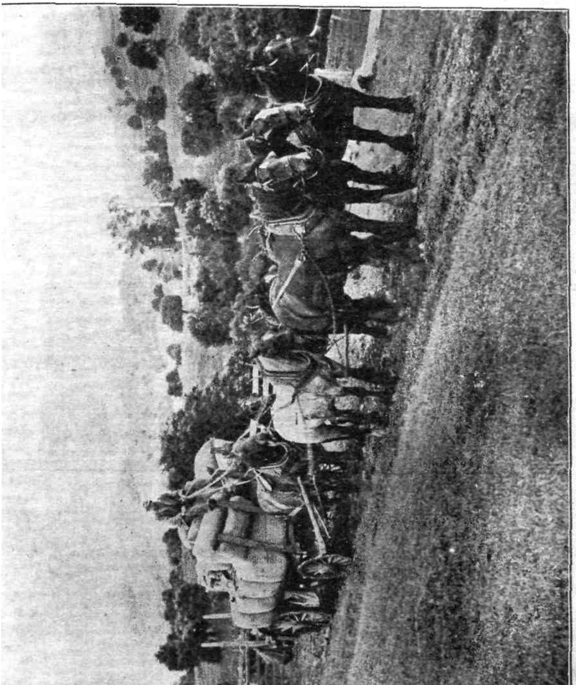
Otago A. and P. Society: Winter Show at Dunedin, 29th, 30th, 31st May, and 1st June.

Waikato Winter Show Association: At Hamilton, 5th to 9th June.

Manawatu and West Coast A. and P. Association: Winter Show at Palmerston North, 19th to 22nd June.

South Taranaki W nter Show Company (Limited): Dominion Dairy Show at Hawera, 2nd to 7th July.

(Secretaries are invited to supply particulars of their show dates.)



MAXIMUM PRICES OF BUTTER.

THE Order in Council of 13th October, 1916, fixing the maximum price of butter in New Zealand, was revoked by a fresh Order, dated 15th February, 1917, which came into operation the following day. The provisions of this Order are contained in the following schedule:—

1. The maximum wholesale price of butter as sold by the manufacturer and delivered in boxes at the factory on the usual trade terms as established at the date of this Order in Council shall be as follows:—

For butter sold for delivery in—	Maximum Price per Pound. s.	d.
February, 1917	1	4
March, „	1	4
April, „	1	4¼
May, „	1	4⅜
June, „	1	4½
July, „	1	4⅝
August, „	1	4¾

2. In the case of butter sold in boxes by the manufacturer otherwise than for delivery at the factory on the usual trade terms aforesaid, the maximum wholesale price thereof shall be a price equivalent, as regards the seller, to the maximum price above mentioned.

3. The maximum wholesale price of butter (whether sold by the manufacturer or any other person) patted, and delivered on the premises of the retailer on the usual trade terms as established at the date of this Order in Council, shall be as follows:—

For butter sold for delivery in—	Maximum Price per Pound. s.	d.
February, 1917	1	5
March, „	1	5
April, „	1	5¼
May, „	1	5½
June, „	1	5½
July, „	1	5¾
August, „	1	5¾

4. In the case of butter (whether sold by the manufacturer or any other person) patted, and delivered on the premises of the retailer otherwise than on the usual trade terms aforesaid, the maximum wholesale price thereof shall be a price equivalent, as regards the seller, to the maximum price fixed by clause 3 hereof.

5. The maximum price of butter as sold by the retailer shall be as follows:—

For butter sold for delivery in—	Maximum Price per Pound. s.	d.
February, 1917	1	7
March, „	1	7
April, „	1	7
May, „	1	7
June, „	1	8
July, „	1	8
August, „	1	8

6. Butter sold without express provision as to the month of delivery shall, for the purposes of this schedule, be deemed to have been sold for delivery in the month in which the contract was made, and the maximum price shall be determined accordingly.

7. Nothing in this Order in Council shall apply to butter destined by the purchaser for exportation and not for consumption or use in New Zealand. "Exportation" includes shipment as ships' stores.

REQUISITION OF WOOL.

A Proclamation dated 20th February, 1917, amends the provisions of the wool-requisition Proclamation of 21st December, 1916, with regard to charges receivable by the broker, in the following terms :—

Clause 9 of the schedule of the said Proclamation is hereby amended by adding the following words :—

"The broker shall be at liberty to charge the owner a reasonable sum for services rendered by him in respect of any wool so rejected, and also in respect of all wool which for any other reason does not become the property of His Majesty pursuant to the foregoing provisions of this Proclamation."

Clause 11 of the schedule to the said Proclamation is hereby amended by inserting, after the words "save so far as hereinbefore expressly authorized in respect of repacking," the words "or in respect of wool that has been rejected by the valuers or the supervising valuer, or in respect of wool that does not become the property of His Majesty pursuant to this Proclamation."

A reference to the text of the schedule published in the January *Journal* (page 76) will make the matter clear.

REMUNERATION OF GOVERNMENT WOOLBROKERS AND FELLMONGERS.

THE conditions of employment of Government woolbrokers and fellmongers respectively, in connection with the requisition of wool and the fellmongering of sheep-skins purchased on behalf of the Imperial Government, include the following terms as regards remuneration :—

WOOLBROKERS.

The Government will pay to the broker for all services rendered by him the sum of $\frac{3}{16}$d. for every pound of wool purchased by the Government through the agency of that broker in pursuance of the scheme.

Such payments will be made by the Government from time to time within fourteen days after the departure of the ship on which the wool has been shipped from the port of shipment.

The Government will also pay to the broker the sum of 6d. per bale, to cover the cost involved in the preparation of shipping documents.

The woolbroker will provide storage free of charge for the wool for a period of twenty-eight days after the date of valuation. After the expiration of that period the Government will pay storage at the rate of 4d. per bale for each week or part of a week during which the wool remains in the woolbroker's possession, provided that the rate of payment for storage after the 30th April, 1917, is to be a matter of subsequent arrangement between the Government and the woolbrokers.

In the case of wool which may be diverted by the Government from the port at which it was originally intended to be shipped, then in so fa as such wool is concerned it is provided that in the case of woolbrokers who are not represented at the final shipping port the Government will recognize a claim by such woolbrokers for reasonable additional expenses incurred by them in respect of final port expenses.

The Government will also pay freight, marine insurance (if required), stamp duty on bills of lading, and wharfage and lighterage charges in respect of the shipment or transhipment of all wool so shipped, together with railage charges (if any) from the store to the ship in the case of Christchurch, Dunedin, Invercargill, Blenheim, and Nelson.

All other costs, charges, and expenses incurred by the broker shall be borne and paid by him, and shall be deemed to be covered by the aforesaid remuneration of $\frac{3}{16}$d. per pound weight.

FELLMONGERS.

The Government will make payment to the fellmonger for all the services rendered by him at the following rates :—

Fellmongering : 2d. per pound on the weight of wool, with 6d. per skin minimum.

Curing pelts : 3s. per dozen all kinds, casks extra.

If the store from which the skins are taken is less than twenty miles by road or railway from the fellmongering-works, delivery shall be taken at the store and the cost of carriage borne by the fellmonger ; if the distance is more than twenty miles the cost of carriage to the works after the first twenty miles will be borne by the Government. Redelivery of slipe wool and pelts to be made at the nearest suitable railway-station, or into store, as the Government may direct. Cost of railway carriage to be borne by the Government.

The cost of any new woolpacks which may be required will be borne by the Government, subject to the fellmonger giving satisfactory evidence that such new packs are of proper quality, and also providing the charge is fair and reasonable.

All other costs, charges, and expenses incurred by the fellmonger shall be borne and paid by him, and shall be deemed to be covered by the remuneration referred to above.

CANTERBURY SEED-GROWERS' ASSOCIATION.

THIS association has maintained its operations during the current season, although so far wheat only has been dealt with. The following varieties, grown under the association's rules and duly inspected and tested, are available for disposal this year : College Hunters or Red Chaff, White Straw Tuscan, Solid Straw Tuscan (all in large supply) ; Purple Straw Tuscan, and Pearl (a small supply of each). Growers are to be found from Waimate in the south to Waikari in the north of the province, so that buyers may have seed from almost any district they desire. Several of the varieties are raised from pure strains originated at the Canterbury Agricultural College, and some of them have been tried for many years and have proved much superior in purity and yield to the commercial sample grown under the same conditions. Information as to names and addresses of growers of the different varieties may be obtained from Dr. Hilgendorf, Canterbury Agricultural College, Lincoln, who is acting as honorary secretary to the association.

PRINCIPAL EXPORTS IN 1916 AND 1915.

THE following table compares the main items of export from New Zealand in 1916 with those for 1915. Special attention is drawn to the quantities.

Item.	Unit of Quantity.	1916.		1915.	
		Quantity.	Value.	Quantity.	Value.
			£		£
Wool	lb.	185,506,859	12,386,074	196,570,114	10,387,875
Frozen meat ..	cwt.	3,326,045	7,271,318	3,591,260	7,794,395
Butter	,,	358,632	2,632,293	420,144	2,700,625
Cheese	,,	949,416	3,514,310	817,258	2,730,211
Sheep-skins (woolled and pelts)	No.	8,335,570	917,633	9,093,850	826,507
Hides	,,	297,418	605,668	270,363	506,189
Tallow	ton	22,472	785,339	26,763	780,828
Phormium-fibre ..	,,	27,674	1,001,725	23,220	571,621
Gold	oz.	292,620	1,199,212	422,825	1,694,553
Kauri-gum ..	*ton*	5,448	339,343	4,575	279,133
Timber	Sup. ft.	71,501,371	381,477	76,741,746	383,616

MEAT-FREEZING WORKS IN NEW ZEALAND.

Name and Address of Company.	Location of Works.	Beef-killing Capacity per Day.	Sheep-killing Capacity per Day.	Storage Capacity, in 60 lb. Carcases Mutton.
Auckland.				
Whangarei Freezing Company, Ltd., Auckland ..	Whangarei Hds.	150	1,000	50,000
Auckland Farmers' Freezing Company, Ltd., Auckland	Southdown ..	200	3,000	66,000
" " "	Horotiu ..	200	3,000	66,000
Westfield Freezing Company, Ltd., Auckland ..	Westfield ..	200	3,000	175,000
R. and W. Hellaby, Ltd., Auckland	" ..	120	500	3,000
Poverty Bay, &c.				
Tokomaru Sheep-farmers' Freezing Company, Ltd. ..	Tokomaru Bay	45	2,500	60,000
Poverty Bay Farmers' Meat Company, Ltd., Gisborne	Kaiteratahi ..	100	2,000	120,000
Gisborne Sheep-farmers' Frozen Meat Company, Ltd., Gisborne	Kaiti ..	150	6,000	150,000
Nelson Bros., Ltd., Gisborne	Taruheru ..	85	2,500	82,000
Hawke's Bay.				
Wairoa Farmers' Co-operative Meat Co., Ltd., Wairoa	Wairoa ..	50	2,000	75,000
North British and Hawke's Bay Freezing Company, Ltd., Napier	Westshore ..	40	1,500	36,000
Thomas Borthwick & Sons (Aus.), Ltd., Christchurch ..	Pakipaki ..	30	1,500	50,000
Nelson Bros., Ltd., Tomoana	Tomoana ..	80	3,000	92,000
Hawke's Bay Farmers' Meat Company, Ltd., Hastings	Whakatu ..	80	2,000	40,000
Taranaki.				
Taranaki Farmers' Meat Company, Ltd., New Plymouth	Smart Road ..	100	2,000	60,000
Thomas Borthwick & Sons (Aus.), Ltd., Christchurch ..	Waitara ..	200	2,000	90,000
Patea Farmers' Co-op. Freezing Company, Ltd. ..	Patea ..	120	1,000	52,000
Wellington.				
Wanganui Meat-freezing Company, Ltd., Wanganui ..	Castlecliff ..	100	2,200	70,000
New Zealand Refrigerating Company, Ltd., Christchurch	Imlay ..	200	6,000	250,000
Otaihape Farmers' Meat Company, Ltd., Taihape ..	Winiata ..	50	1,200	65,000
Feilding Farmers' Freezing Company, Ltd., Feilding ..	Aorangi ..	100	2,200	140,000
National Mortgage and Agency Company of New Zealand, Ltd., Dunedin	Longburn ..	60	1,500	60,000
Wellington Farmers' Meat Company, Ltd., Masterton	Waingawa ..	250	6,000	239,000
Gear Meat Preserving and Freezing Company, Ltd., Wellington	Petone ..	100	10,000	300,000
Wellington Meat Export Company, Ltd., Wellington ..	Ngahauranga ..	120	8,000	240,000
Marlborough.				
New Zealand Refrigerating Co., Ltd., Christchurch ..	Picton ..	30	1,000	23,000
Nelson.				
Nelson Freezing Company, Ltd., Nelson	Stoke ..	..	350	10,000
Canterbury.				
Canterbury Frozen Meat Company, Ltd., Christchurch	Belfast ..	50	7,000	130,000
" " "	Fairfield ..	..	4,000	100,000
" " "	Pareora ..	25	4,500	125,000
New Zealand Refrigerating Co., Ltd., Christchurch ..	Islington ..	50	7,000	235,000
" " " ..	Smithfield ..	50	6,000	126,000
North Canterbury Sheep-farmers' Co-operative Freezing Company, Ltd., Christchurch	Kaiapoi ..	50	2,500	75,000
Thomas Borthwick & Sons (Aus.), Ltd., Christchurch ..	Belfast ..	..	4,000	60,000
Otago.				
New Zealand Refrigerating Co., Ltd., Christchurch ..	Pukeuri ..	..	3,000	140,000
" " " ..	Burnside ..	50	3,500	130,000
South Otago Freezing Company, Ltd., Balclutha ..	Finegand ..	30	1,200	85,000
Southland.				
Birt and Co., Ltd., Invercargill	Ocean Beach ..	100	2,500	110,000
Southland Frozen Meat Company, Ltd., Invercargill ..	Mataura ..	50	2,000	87,000
" " " ..	Makarewa ..	70	2,000	14,000
" " " ..	Bluff ..	...	..	114,000
Total	..	3,485	126,150	4,201,000

Works under construction: Kakariki (Wellington Meat Export Company, Ltd.), and Whakatane (East Coast Co-operative Freezing Company, Ltd., Tauranga).

HIGH COMMISSIONER'S CABLED MARKET REPORTS.

London, 17th February, 1917.

Meat.—The demand has considerably fallen off for all descriptions of meat, on account of the decreased consumption in consequence of the Food Controllers' recommendations. New Zealand frozen-meat quotations are nominal. By order of the Government none has been released during this week, Government considering that heavy supplies of home-killed mutton and beef should suffice for present requirements. New Zealand mutton, per lb., 8⅞d.; ewe mutton 8½d. Argentine mutton, heavyweight 10¼d., lightweight 10½d.; New Zealand and Australian lamb 10d.; Argentine lamb, heavyweight 11½d., lightweight 12d. New Zealand bull beef, hinds 9d., fores 8d. Argentine chilled beef, hinds 11¾d., fores 10¼d.

Butter.—Unsettled market owing to the great uncertainty of arrivals. No official quotations with the exception of French, per cwt., 212s. to 217s. Australian, salted and unsalted, 212s. to 216s. Irish factory 194s. to 202s. New Zealand, salted and unsalted, 220s. to 222s. and 220s. to 224s. Argentine 210s., unsalted 210s. to 212s.

Cheese.—Market continues firm. Prices are higher owing to continued small supplies. Canadian, white and coloured, per cwt., 160s. to 164s. English cheddar 162s. to 165s. States flats: believe supply will be large.

Hemp.—Market firm at the advance. It is reported that nothing is offering here from New Zealand, and business is confined to lots at second-hand. Quotations are nominal. New Zealand good-fair £66 per ton; fair £64; forward shipment at same price. Fair Manila, £85.

Wheat.—Market quiet but firm. Quotations are nominal. Canadian, per quarter, 80s. 6d.; Argentine 79s. 6d.; Australian 82s.

Oats.—Firm market. Offerings are very small. New Zealand, per quarter, 51s.

24th February, 1917.

Meat.—All descriptions of meat are in slow demand, for reasons given last week. Only small quantities of New Zealand available. New Zealand and Australian mutton, per lb., 8⅞d.; ewe mutton 8½d. Argentine mutton, heavyweight 10½d., lightweight 10¾d. New Zealand and Australian lamb 10d.; Argentine lamb 12d. Argentine chilled beef, hinds 11½d., fores 10d.

Butter.—The market is firm, and prices continue to advance owing to continued small supplies. Danish, no arrivals. Australian, per cwt., 214s. to 218s.; unsalted 212s. to 216s. Irish factory 195s. to 202s. Dutch, no arrivals. New Zealand 224s. to 226s.; unsalted 222s. to 224s. French 212s. to 219s. Argentine, unsalted, 210s. to 212s.

Cheese.—The market continues firm. Stocks are very light and prices are higher. Canadian, white and coloured, per cwt., 166s.; practically none offering. English cheddar, no official quotations. States flats, 162s. to 164s.

Hemp.—The market is dull, but prices are firm. No New Zealand shipments offering. Quotations are nominal. Forward shipment, good-fair, per ton, £66; fair, £64.

Wheat.—Market remains firm. Government minimum price for English wheat is fixed at 60s. for 1917.

Oats.—The market is firmer. Minimum price is fixed at 38s. 6d. during this year.

Hops.—The market is very unsettled on account of Government brewing-restrictions. Government informed me license cannot be obtained to import hops from any source this year.

3rd March, 1917.

Meat.—All descriptions of meat continue in poor demand on account of decreased consumption. New Zealand frozen-meat prices are unchanged. Argentine mutton and lamb prices are higher owing to continued small supplies of New Zealand mutton and lamb. New Zealand and Australian mutton, per lb., 8⅞d.; ewe mutton 8½d. Argentine mutton, heavyweight 10¾d., lightweight 11d. New Zealand and Australian lamb 10d. Argentine lamb, heavyweight 12¼d., lightweight 12¼d. New Zealand beef, no supplies available. Argentine beef, no arrivals this week.

Butter.—The market continues firm. No official quotations with the exception of French, per cwt., 212s. to 219s. Irish factory 194s. to 202s. Australian 214s. to 218s., exceptionally 220s.; unsalted 214s. to 218s. New Zealand, salted and unsalted, 224s. to 220s.; good to fine quality 218s. to 222s.

Cheese.—Market practically cleared. No quotations with the exception of Canadian, white and coloured (stocks light) 172s. to 176s. per cwt. Estimated Canadian and States cheese-stocks London, Liverpool, and Bristol, 49,500 boxes, against 96,000 at same time last year. Estimated New Zealand and Australian cheese-stocks London and Bristol, nil, against 21,100 crates at same time last year.

Hemp.—Market quiet but firm. It is reported that New Zealand shipments are going direct to America. Nothing offering here. Manila market stronger. Quotations are nominal. Manila fair, per ton, £94; coarse £77. New Zealand good-fair £66 10s.; fair £64 10s. March–May shipment: New Zealand good-fair £66; fair £64. Fair Manila £90; coarse £73 10s. The output of hemp at Manila for the week ending last Saturday was 19,000 bales.

Wheat.—The market is firm with more inquiry. Australian, per quarter, 82s.; Canadian 80s. 6d.; Argentine 79s., to arrive.

Oats.—Market firm owing to reduced supplies. New Zealand 51s. per quarter.

10th March, 1917.

Meat.—There is no material change in the market. Home-killed mutton and beef are in good supply. Argentine mutton and lamb prices are higher owing to continued small supplies of English lamb. New Zealand and Australian mutton arrivals, per lb., 8⅞d.; ewe mutton 8½d. Argentine mutton, heavyweight 11¼d., lightweight 11½d. New Zealand lamb 10d.; Argentine lamb 12⅜d. New Zealand beef, no supplies available. Argentine chilled beef, hinds 11½d., fores 10¼d.

Butter and Cheese.—Market for butter continues firm owing to the absence of Dutch and Danish. Demand is mostly for colonial salted butters. Cheese-market continues firm owing to continued small supplies. By the authority of the Food Controller the following maximum wholesale prices have been fixed for both butter and cheese during the next two weeks: Danish and finest New Zealand butter, salted and unsalted, 224s. per cwt.; Dutch creamery, Argentine, and Irish creamery (heavy buying by Home and Continental trade) 218s.; French 217s.; American creamery 214s. English cheddar cheese, per cwt., 165s.; Canadian white and coloured 162s.; States flats 160s.

Hemp.—Market firm and prices continue to advance. Good-fair New Zealand, per ton, £69; fair £67. Fair Manila £90; coarse £77. March to May shipment: good-fair New Zealand £69; fair £66. Fair Manila £90; coarse £75. The output of hemp at Manila for the week ended last Saturday was 22,000 bales.

Wheat.—Market firm with an upward tendency. Australian, per quarter, 83s.; Canadian 81s.; Argentine 80s.

Oats.—Market firm with hardening tendency.

CHEVIOT BEEKEEPERS' FIELD-DAY.

THE Cheviot beekeepers held their annual field-day on 24th February at Mr. J. Rentoul's apiary. The Apiary Instructor for the Canterbury District, Mr. L. Bowman, devoted the morning session to the school-children, giving an address on the hive, showing and explaining the various parts and uses, followed by the natural history of the honey-bee. Mr. Rentoul in his opening address briefly outlined the development of the beekeeping industry, pointing out the advantages of organization, co-operation, and the benefits of having an export trade established. A demonstration in handling bees was then given by the Apiary Instructor: a hive was opened, and during examination various items were pointed out and explained. The Instructor also made a few remarks on bee-diseases, urging beekeepers to be always on the watch, and to deal promptly with foul-brood, the great enemy of beekeeping, so as to stamp out the scourge. Mr. R. McKnight gave a short address and practical demonstration on modern queen-rearing and grafting cells on the Swarthmore plan, showing visitors queen-cells in various stages of development, and finally queens hatching. The making of comb-foundation was next demonstrated. The Instructor showed the crude wax and the various processes it undergoes, while Mr. Rentoul and Mr. McKnight attended to working the mill. Modern methods of extracting honey were also demonstrated, a steam-heated knife being used in uncapping the combs, while Mr. Rentoul's assistant attended to the power-driven extractor, to which is attached a power-driven rotary pump carrying the honey as it is extracted along a pipe to the strainers over the honey-tank, thus saving much labour.

EXPORT OF CHEESE.

THE Comptroller of Customs notified in the *Gazette*, under date 7th February, 1917, for general information, that Stilton cheese and dairy cheese may be exported to consignees (other than the British Government) in the United Kingdom and British possessions and protectorates. Applications in connection with shipments must be made to the local Collector of Customs, specifying the marks and numbers, number of packages, names of shippers and consignees, names of exporting-vessels, and ports of final departure from New Zealand.

STOCK EXPORTED.

THE following table shows the numbers and descriptions of stock exported from the Dominion during the month of February, 1917:—

Port of Shipment.	Horses.		Sheep.			Cattle.		Pigs.	
	To Australia.	To Eastern Pacific.	To Australia.	To Eastern Pacific.	To San Francisco.	To Australia.	To Eastern Pacific.	To Eastern Pacific.	To Australia.
Auckland ..	..	6	..	166	..	..	18	46	..
Gisborne ..	..	..	..	..	..	..	..	..	..
Napier ..	..	..	..	..	..	..	..	..	..
Wellington ..	..	..	..	..	..	..	..	..	..
Lyttelton ..	..	..	262	..	..	..	..	..	..
Dunedin ..	..	..	15	..	..	..	..	..	..
Bluff ..	..	..	31	..	..	..	..	..	..
Totals ..	..	6	308	166	..	..	18	46	..

The following are particulars of horses shipped: 4 hack mares, 2 pony mares.

STOCK IN QUARANTINE.

THE following stock was received into quarantine during the month of February, 1917:—

No.	Description.	Sex.	Port of Origin.	Owner or Agent.	Address.
			MOTUIHI ISLAND (AUCKLAND). Nil.		
			SOMES ISLAND (WELLINGTON).		
1	Ayrshire calf ..	Male ..	New York	P. M. J. Oates ..	Carterton.
8	Sleigh dogs ..	..	Antarctic ..	Sir E. Shackleton	Wellington.
8	„ pups ..	..	„	„	„
2	Aberdeen Angus bulls	Male ..	London ..	Williams and Kettle	„
			QUAIL ISLAND (LYTTELTON).		
3	Collie dogs ..	Male ..	London ..	J. Lilico ..	Lochiel.
1	„ dog ..	Female	„ ..	„ ..	„
2	„ pups ..	Male ..	„ ..	„ ..	„
2	„ „ ..	Female	„ ..	„ ..	„

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INCREASE THE WHEAT-PRODUCTION!

IN this third year of the world-war the vocation of the man on the land to produce the essential food of the community becomes more than ever a great responsibility. As regards the leading food products of New Zealand agricultural industry — meat and dairy-produce—no stimulus is needed to fully maintain their output. But in the case of the most essential of foodstuffs — wheat — a position has been reached when in order to supply even our own domestic requirements purposeful energetic action, and doubtless some sacrifice, are necessary on the part of the farmers of the Dominion. Two years ago a rally in wheat-growing raised the country's wheat acreage to a satisfactory level, but last season's sowings showed a great drop—to a point, in fact, below the safety line. A minimum of a quarter-million acres is necessary to fairly ensure the Dominion's requirements, this meaning an increase of some 30,000 acres over last year's area. The country looks to its agriculturists to at least make up the deficiency.

It is true that Australia can at present supply the Dominion with wheat from its surplus, but by growing our requirements within our own borders much precious shipping-space may be saved. Moreover, owing to the present relative scarcity of wheat in the open markets of the world, all Australia's surplus is in demand for the Mother-country. The rational desire for a self-contained New Zealand as regards essential commodities must also be given strong consideration. It should be intolerable for a self-reliant people, inhabiting a fertile land capable of supporting many millions, to depend on other countries for its "staff of life."

Farmers are not asked to take undue financial risks in growing wheat. A fair price—compared with pre-war rates—is guaranteed by the State for next season's crop. The matter resolves itself mainly into one of tillage, with its attendant labour factor. Farmers growing wheat may rest assured that so far as possible every consideration will be given to their case and that of their trained employees engaged in the work. So far as the provision of labour in the future is concerned, the Government and the National Efficiency Board are fully alive to the needs of the situation, and a strong endeavour will be made to organize labour for essential industries throughout the Dominion.

While, owing to natural conditions, South Island farmers are mainly concerned in the matter of wheat-growing, the North Island can and should do an appreciable share, if only to economize transport. It must also not be overlooked that minor but important rural industries, such as poultry-keeping, are largely dependent on wheat and its by-products.

The existing war conditions call for broad views and the basing of our actions on national and patriotic grounds. I am confident that the farming community has only to fully realize the position as outlined above in order to rise to the occasion and make ample provision for the next wheat crop. The season of autumn sowing is at hand. With good will, a fair effort, and normal climatic conditions, our farmers will not only supply ordinary requirements, but build up a reasonable grain reserve against the emergencies of these pregnant times.

W. D. S. MacDonald,
Minister of Agriculture.

POTASH IN NEW ZEALAND AND OTHER COUNTRIES.

P. G. MORGAN, M.A., F.G.S., Director, New Zealand Geological Survey.

INTRODUCTION.

THE element potassium, according to F. W. Clarke, the distinguished chief chemist of the United States Geological Survey, forms 2·49 per cent. of the earth's solid crust, and therefore potassium oxide, or "potash," as it is familiarly though ambiguously called,* enters into the composition of the average rock to the extent of almost exactly 3 per cent. According to a somewhat later estimate by Clarke, potassium oxide forms 2·98 per cent. of the lithosphere.† It is therefore evident that the rocks forming the outer zone or crust of the earth contain inexhaustible supplies of potash, and that no fear of the world ever being really short of this substance need be entertained.

Some rocks—for example, limestones—contain little potash, but most have 2 per cent. or more, and some may have a potash-content of 10 or 11 per cent., or exceptionally as much as 15 per cent. The inorganic constituents of most soils—that is to say, the great bulk of all soils except the few composed mainly of humus—or, in other words, the gravel, sand, silt, clay, &c., are of course derived from the rocks that form the earth's crust, and therefore contain more or less potash. This, however, in some soils may be in small quantity, either because the original rock-source did not contain much potash, or because chemical changes have induced the removal of that substance. In either case the "available potash" is likely to be very low. In many soils, again, the total potash present may far exceed that apparently necessary for vigorous plant-growth, and yet the "available potash" may nevertheless be deficient. In these cases the application of lime, either as quicklime or as ground limestone, may for a generation

* Potash originally meant impure potassium carbonate (as contained in wood-ashes), and the name is still frequently used indiscriminately to indicate potassium carbonate, oxide, or hydrate. There being two potassium carbonates, the name is actually applied to at least four different substances.

† "Data of Geochemistry," 3rd edition, 1916, p. 32, U.S. Geological Survey Bulletin No. 616. Clarke calculates that the average igneous rock contains 2·99 per cent. of potash, the average shale 4 per cent., the average sandstone 1·31 per cent., and the average limestone 0·33 per cent.

satisfactorily overcome the difficulty due to the lack of potash in a form available for plant-food. Ultimately, however, a soil treated only with lime will have its accessible potash so far reduced that it will fail to respond to fresh applications. This is exemplified by the saying "Lime enriches the father but impoverishes the son." Lime, therefore, is not a substitute for potash, and merely postpones the day of reckoning.

The problem of how to supply potash to soils originally deficient in that substance, or made so by long-continued use, with or without the application of lime, or requiring an increased supply of potash for some special purpose, still has to be studied. In the days before the Great War the immense mineral deposits of Stassfurt furnished relatively cheap potash to all parts of the world, but with the cutting-off of that supply the price of potash has increased manyfold, and other sources are being vigorously sought. This search is, indeed, but an intensification of a quest that, stimulated by the rising charges of the German monopolists, began at least as far back as 1910. The present article is intended to give some general information concerning the present potash situation, the possible sources of potash, and the methods by which it is hoped to render that potash available to the agriculturist and other consumers.

SOURCES OF POTASH.

Until the discovery of the wonderful Stassfurt deposits, in 1857, the world depended for its potash chiefly upon that furnished by the ashes of forest-trees and of seaweeds (kelp). Potassium nitrate (nitre, or saltpetre) occurs in considerable quantity in the soils of hot and moderately dry countries, such as portions of India, Persia, Egypt, and Spain; in fact, nearly all soils may contain small quantities. It is also a constituent of some cave deposits. In this connection may be mentioned the great deposits of the similar salt, sodium nitrate, or Chile saltpetre, that occur in northern Chile, and have been worked for many years past, largely for the purpose of supplying the agriculturist with nitrogenous manures. Valuable sources of potash are the molasses obtained as a by-product in the manufacture of beet-sugar, and the impure potassium sudorate, known popularly as "suint" or "grease," that adds considerably to the weight of raw wool. New Zealand exports with its wool much potash that with a proper organization of industry could advantageously be retained in the Dominion.

Sea-water, as is shown in a later paragraph, contains a small amount of potassium, mainly or wholly in the form of chloride. The waters of some salt springs and lakes carry considerably more potassium than sea-water. This becomes concentrated in the liquor,

or "bittern," that remains when the brine is evaporated down to the point at which most of the common salt crystallizes out. At present prices the recovery of potash as a by-product when common salt is being obtained from sea-water is worth consideration.

There is a gradual passage from soils containing moderate amounts of water-soluble potash compounds, such as nitre, to the surface deposits of various kinds of soluble salts known in western North America as "salines." Deposits of this kind, which may accumulate through the drying-up of salt lakes or in other ways, occur in all arid regions—for example, Central Asia, Arabia, parts of Australia, northern Africa, and more especially in Nevada, California, and other parts of the western United States. They nearly all contain appreciable quantities of potash, but in only a few cases are they worth working for their potash-content alone. In general their main constituent is sodium chloride, or common salt. In bygone ages similar saline deposits were formed on the existing land-surface, in salt lakes, or in isolated portions of the sea. Many of these were ultimately covered by sediments of greater or less thickness, and thus preserved to the present day. Of this nature are the deeply buried potash-deposits of Stassfurt, of the Kalusz district in Galicia, and of the Mulhausen region in Alsace.

A few words about occurrences of soluble potash salts in countries outside Germany may here be said. The western part of the United States undoubtedly possesses considerable deposits of this kind, but so far as they have been explored they are of uneven and, on the whole, of low-grade quality. Attempts to work them are being made at Searles Lake, California, and in other localities—for example, at Owen's Lake, Inyo County, California, and at Great Salt Lake, Utah. Deposits of the Stassfurt type have been shown by boring to exist in Texas, and American geologists predict with some confidence that similar occurrences will also ultimately be found in other States of the Union. A few years ago a promising discovery of potash salts was made near Barcelona, in Spain, and the hope is entertained that the working of these will lead to the breaking of the German monopoly; but since the latest information to hand concerning the Barcelona deposits shows that their development is not proceeding very rapidly it is evident that the German deposits, though not unique in character, are for the time being still without a serious competitor in the world's markets. Many countries, however, now realize the political dangers that lurk in German control of commercial products or enterprises, and consequently are not likely to fail in encouraging the production of potash within their territories, whether from soluble potassium salts or from other sources.

It is perhaps as well to remind the reader at this point that the potash of the deposits mentioned above has been derived from the rocks forming the crust of the earth. When these are destroyed by weathering and the other processes involved in the wearing-down of the land-surface that is continually going on, their constituents are scattered far and wide. Much of the rock substance remains in solid forms, such as sand or clay; but a small portion—or, in the case of carbonate rocks such as limestone, a large portion—becomes dissolved in the water that plays such an important part in the erosion of land-surfaces. A great deal of the potash remains undissolved, or speedily enters into new substances of a comparatively insoluble nature—for example, the mineral mica. As a rule the dissolved potash reaches the sea, in which it is presumably slowly accumulating, although part is continually being removed from solution by the formation of glauconite, by seaweeds, and by absorption in silts and muds.

By a combination of favourable conditions, however, it may happen that an unusual amount of potash in some soluble form—for example, the chloride, sulphate, or nitrate—is set free by the weathering of the rocks of a given region, and by a second combination of favourable conditions the potash may be concentrated in inland lakes or depressions, or in cut-off arms of the ocean, which finally by their drying up cause the formation of workable deposits. Having been formed, the potash-deposit may or may not be covered by earthy sediments, and these, with their underlying or contained soluble salts, may or may not survive subsequent geological changes. Thus it can easily be imagined that buried potash-deposits of profitable quality and extent are extremely rare. The case is somewhat different with sodium chloride (common salt), because this substance is found much more commonly and much more abundantly in solution than potash compounds. Consequently accumulations of sodium chloride, either as surface deposits or buried beneath later sediments in the form of rock-salt, are much more likely to occur than those of soluble potash compounds. Various other sodium compounds are also relatively abundant as compared with the corresponding potassium salts.

The potassium present in river-water is roughly one-third of the sodium, but in sea-water it is little more than one-thirtieth the sodium, instead of one-third, as might be expected.* Although the rocks of the earth's crust contain nearly as much potash as soda, the much greater proportion of the latter substance in river and spring waters is easily explained by the fact that potash-bearing

* See Clarke, F. W.: "Data of Geochemistry," 3rd ed., 1916, Chap. III, and p. 138.

minerals, on the whole, are less soluble than soda-bearing minerals, and more especially by the fact that there is a strong tendency for potash, during the breaking-up of rocks by weathering or similar process, not to go into solution, but to combine with silica and other oxides to form the mineral muscovite. Soils, also, can extract more potash than soda from percolating solutions that carry these substances. It has been suggested,* no doubt correctly, that the suspended silt carried by streams removes more or less potassium from solution, which therefore is deposited with the sediments.

All this, however, does not satisfactorily explain why there is relatively such a great discrepancy between the amounts of sodium and potassium present in river-water and in sea-water respectively. It is possible, though not likely, that sea-water originally contained a considerable amount of sodium salts, but hardly any potassium compounds. Even so, only a part of the discrepancy is thus accounted for. As has already been stated, seaweeds contain a considerable amount of potash; but it is evident that very little of this substance can be permanently abstracted by marine plants, for after death these decay in the sea or on its shores, and the potassium compounds are once more dissolved and return to the ocean waters. Much potash, it might be supposed, is precipitated by absorption in the sedimentary material that enters the sea from the rivers or as atmospheric dust. The blue and green muds of the deep ocean contain about 2·25 per cent. of potash, whilst the red clays, which are believed to represent atmospheric dust (largely of volcanic origin), contain 2·85 per cent. of the same substance.† These percentages, being lower than the average potash-content of the earth's crust, do not in themselves indicate that the deep-sea muds abstract much potassium from the water in which they slowly settle.

Finally, the removal of potash from sea-water by the formation of glauconite may be considered. This mineral is of common occurrence in marine sediments, both ancient and modern. The mode in which it is formed is obscure, but it is known to develop mainly in the tests or shells of dead Foraminifera. It is generally supposed that the potash of glauconite is derived, in the presence of dead organic matter, from the sediments of the neighbouring sea-bottom. Although this hypothesis, due to Murray and Renard, is supported by a series of possible chemical reactions,‡ it does not account at all satisfactorily for the widespread thick beds of greensand found in Cretaceous and Tertiary formations. It may be suggested that the glauconite of greensands obtains its potash mainly, if not altogether, from that held in solution by sea-water. No statement as

* Clarke, F. W.: *Op. cit.*, p. 138. † Clarke, F. W.: *Op. cit.* p. 514. ‡ See Clarke, F. W.: *Op. cit.*, pp. 135–136, and 516–518.

to how this is done can be made, beyond hazarding the guess that possibly some living organism helps in the process, and that conceivably the potash liberated by decaying algæ may assist in the formation of glauconite. Such an hypothesis, though as here outlined merely a skeleton, explains the poverty of sea-water in potash, as well as indicates the most probable source of an essential constituent of glauconite.

POTASH MINERALS.

For the purposes of this article potash minerals may be divided into two classes: soluble—that is, those which dissolve readily in water, as sugar does in tea; and insoluble, or those that are not appreciably dissolved by pure water. The chief soluble potassium minerals are nitre (or saltpetre)—that is, potassium nitrate—and carnallite, the double hydrous chloride of potassium and magnesium that gives such great value to the Stassfurt deposits. Kainite is a similar salt, also found at Stassfurt, in which magnesium sulphate takes the place of magnesium chloride. The name is often applied to the potash material exported from Stassfurt, of which, however, so far as the writer knows, carnallite is usually the predominant constituent. The chief insoluble minerals containing potash in considerable quantity are alunite, potash feldspar, leucite, muscovite (or white mica), biotite (or black mica), and glauconite.

For general information a few notes concerning each of the principal potash minerals may here be given:—

Nitre (saltpetre, or potassium nitrate) has the chemical symbol KNO_3, and when pure contains 46·5 per cent. of potassium oxide. It may form in any soil through the action of microbes. In dry climates, as already mentioned, it accumulates in the soil, and may then appear on the surface in the form of thin white crusts and silky tufts. Whether in all cases the formation of nitre is connected with microbic action may be regarded as an open question.

If thrown on burning charcoal or any kind of fire, nitre deflagrates—that is, it causes violent combustion. The resulting flames are violet-coloured. Sodium nitrate behaves similarly, except that it produces a strongly yellow flame. All potassium salts, if not too much contaminated by sodium or other flame-colouring substance, when introduced into a colourless flame similarly impart a violet tinge to it. By viewing the flame through a piece of glass coloured blue by cobalt oxide, or through a medicine-bottle filled with a weak aniline-dye solution, the violet tint caused by potassium may be detected in the presence of sodium and other disturbing substances. Several recent articles on potash mention the flame and other

tests, and to these, or, better still, to works dealing specially with mineralogy or chemistry, the reader may be referred for further information.*

Carnallite has the chemical symbol $KCl.MgCl_2 + 6H_2O$, and when pure contains 14·1 per cent. potassium, equivalent to 16·9 per cent. potassium oxide. It is a brittle, very soft substance, of a greasy lustre, and milk-white to reddish in colour. It may be translucent or even transparent. After being exposed to sunlight, or on being gently heated, in the dark it is seen to phosphoresce. It has a bitter taste, and on exposure to moist air absorbs so much moisture that it finally deliquesces—that is, forms a liquid solution.

Kainite (or kainit) has the chemical symbol $MgSO_4.KCl + 3H_2O$, and when pure contains 15·7 per cent. of potassium, equivalent to 18·9 per cent. of potassium oxide. The commercial substance known as kainite is, as previously stated, a variable mixture of carnallite, kainite, and other potassium salts found at Stassfurt. As sold, it has a minimum potassium-oxide content of 12·4 per cent. Probably the average potash-content is very little above this minimum. There are, however, higher grades of crude German potash salts, known as "hard salt" and "manure salt," with 16 and 20 per cent. respectively of pure potash.

Sylvite (or sylvine) is potassium chloride (KCl), and when pure contains 52·4 per cent. of potassium, equivalent to 63·1 per cent. of potassium oxide. It occurs in small quantity at Stassfurt and Leopoldshall in Germany, at Kalusz in Galicia, and at Mount Vesuvius.

Sylvinite is apparently not a definite mineral, but a mixture of potassium and sodium chlorides with their sulphates. It occurs in workable amount with other potash salts at Stassfurt.

Polyhalite, a substance to which is assigned the formula $K_2SO_4.MgSO_4.2CaSO_4+2H_2O$, also occurs at Stassfurt in some quantity. The chemical symbol shows that it is composed of several sulphates with some combined water, and does not contain a very high percentage of potash.

Alunite is a hydrous sulphate of aluminium and potassium, containing when pure 11·4 per cent. of potash — that is, potassium oxide. Chemically it may be represented by the symbols $K_2O.3Al_2O_3.4SO_3.6H_2O$ or $K(AlO)_3(SO_4) + 3H_2O$, or in other

* For description of simple methods of testing for potash see Hicks, W. B.: "Simple Tests for Potash," Mineral Resources of the United States for 1915, Part II, pp. 129–131 (published 1916); and Winterbottom, D. C.: "Potash," part of Bulletin No. 2, Department of Chemistry, South Australia, 1916, pp. 27–29. Hicks's paper is included in a separate publication by W. C. Phalen, with the title "Potash Salts."

ways. It forms seams in volcanic rocks, and is not uncommon in some classes of metal-bearing veins. Extensive alunite-deposits occur in Utah, United States, and these are now being worked for agricultural and other purposes. At Bulladelah, near Port Stephens, N.S.W., since 1890 an alunite-deposit has been extensively quarried and used in the manufacture of alum.* Alunite-deposits of high grade occur at Carrickalinga Head, Spencer's Gulf, South Australia.† In New Zealand alunite is recorded as occurring near Rotorua, and in the Patua (or Kaitake) Range, Taranaki. Though this mineral has not been definitely recorded as occurring in the Hauraki Goldfield, its presence in the gold-silver veins of that area is likely. Throughout the thermal district of the North Island the conditions for the occurrence of alunite are favourable, and therefore its discovery in workable amount is not improbable.

Potash feldspar (orthoclase, microline) is a silicate of alumina and potash which forms an important constituent of granite and several other common igneous rocks. Occasionally large veins or dykes, composed in great part of feldspar, are found to traverse granitic rocks. Pure orthoclase, as represented by the formula $K_2O.Al_2O_3.6SiO_2$ (or $KAlSi_3O_8$), contains 16·9 per cent. of potassium oxide. Microcline has the same chemical composition as orthoclase, but differs slightly in its crystal form. The potash feldspars orthoclase and microcline must not be confounded with other varieties of feldspar, such as the soda, soda-lime, and lime feldspars, which contain little or no potash. Soils formed from rocks that contain much orthoclase or allied feldspar are likely to be rich in total and in "available" potash.

Leucite is a silicate of potash and alumina, in many respects closely related to orthoclase, but mineralogically distinct. It is represented by the symbol $K_2O.Al_2O_3.4SiO_2$ (or $KAlSi_2O_6$), and when pure contains 21·5 per cent. of potash. In some volcanic areas—for example, Leucite Hills, Wyoming, United States—leucite is an abundant rock-constituent, but it is of extremely rare occurrence in New Zealand.

Muscovite (or white mica) is a more or less complex silicate of somewhat varying composition, which ordinarily contains from 10 to 11·8 per cent. of potassium oxide. It is a common rock-constituent, being prominent in most granites and schists—for example,

* Krause, F. M.: "Mineralogy" (for Australian Readers), 1896, pp. 172–173; Ann. Rep. Dept. Mines, N.S.W., 1916, p. 62.

† *Australian Mining Standard* (Vol. 50), 8th Dec., 1913, p. 550. See also Ward, L. Keith, "Alunite in South Australia," in "A Review of Mining Operations in the State of South Australia during the Half-year ended Dec., 31st, 1913," 19, 1914, pp. 39 *et seq.*

the mica-schist of Central Otago. It is also found in many sandstones, shales, slates, and similar sedimentary rocks.

Muscovite is a refractory mineral, and as a soil-constituent decomposes with great difficulty: hence it appears abundantly in the Central Otago soils, and also in some Westland soils, being there derived largely from the schistose rocks of the Southern Alps. Another consequence of its unyielding nature is that it furnishes its potash very slowly to plants, and hence micaceous soils frequently require treatment with lime in order to enable them to grow certain crops, more especially root crops, with the best results. Mr. B. C. Aston* mentions European experiments that seem to show that muscovite as a soil-constituent is not so refractory as potash feldspar, but until it is definitely established that the conditions of the experiments were comparable with ordinary soil conditions, and that the mica used was wholly muscovite and not in part or whole one of the more decomposable varieties, the present writer is not inclined unreservedly to accept the inference sought to be drawn by those who made the experiments.

Biotite (or black mica) is a highly complex silicate which usually contains 7 to 10 per cent. of potassium oxide. It is a common rock mineral, but decomposes much more readily than muscovite, and therefore, as a rule, is not a soil-constituent to a notable extent.

Glauconite is a hydrous silicate of iron and potassium which usually contains from 6 to 8 or 9 per cent. of potassium oxide. Its origin is discussed on a previous page. It forms the principal constituent of the soft dark-green rocks known as "greensands," and in many cases is more or less abundant in sandstone and limestone. Most greensands, it may be noted, contain an appreciable amount of calcium or other phosphate, so that they have a double claim on the attention of the agriculturist. Some greensands also contain more or less carbonate of lime, and thus possess three constituents of agricultural value.

Numerous other minerals containing appreciable amounts of potash have been identified by mineralogists and chemists, but these do not require mention in the present article.

NEW ZEALAND SOURCES OF POTASH.

As already mentioned, the earth's crust contains about 3 per cent. of potash, and there is little reason for supposing that there is any deficiency of this substance in the rocks of this country. The published analyses of New Zealand rocks, however, if averaged

* "Potash in Agriculture," this *Journal*, December, 1916, p. 453.

as they stand, would show a lower percentage of potassium oxide than that assigned to the average rock by F. W. Clarke. A great number of the analyses represent andesites, rocks that are somewhat low in potash; whilst there are comparatively few analyses of those igneous rocks, such as granite and rhyolite, that have a high potash-content. It may be of interest to note that the average potassium-oxide content of seventy-five New Zealand igneous rocks, analyses of which are published in Geological Survey bulletins, is 2·26 per cent.; whilst fifty analyses of sedimentary rocks, selected from the same publications, show an average of 2·76 per cent. of potash. The combined average is 2·46 per cent. In making the calculation some analyses of igneous rocks that occur in very small amount and happen to be very low in potash—for example, the rodingite of Nelson—were averaged, and counted only as a single analysis. No analyses of limestone showing potash-content are given in the geological bulletins, and thus, since limestone contains very little potash, the sedimentary-rock average is slightly over the mark. If, however, due weight had been given to the granites and allied rocks, the average potash-content of the igneous rocks would have been considerably raised. It may be safely said that a properly weighted average would show a potash-content of at least 2·8 per cent. for New Zealand rocks. This statement may be put into a more concrete, if less accurate, form by saying that a ton of road "metal" contains on the average 60 lb. or more of potash, which if separated from the matrix would be worth at present prices from £3 to £12, according to the chemical form (chloride, sulphate, carbonate, or hydrate) in which it is supposed to be extracted.

If it be granted that New Zealand rocks as a whole are not markedly deficient in potash, it follows that the soils, being derived from the rocks, will under ordinary circumstances contain a normal amount of potash in some form or other. If the rocks of a given district contain their potash in the form of minerals, such as feldspar, that are readily decomposed by weathering, and if the rainfall is not excessive, the soils of the district will probably be high in "available" potash, but under opposite conditions they will be deficient in potash available as a plant-food. In Central Otago the potash of the soils is mainly locked up in slowly decomposing white mica or muscovite derived from the mica-schists, but the low rainfall allows "available" potash formed by the decomposition of mica and feldspar to remain in the soil. The river-flats of Westland have abundant potash in their soils, also largely in the form of muscovite, but the excessive rainfall washes potash in the "available" form out of the soil. Hence, as

pointed out by Mr. B. C. Aston,* Westland and similar soils need the addition of lime in order to promote the more rapid decomposition of the mica and other potash-bearing minerals such as feldspar, and thus to increase their fertility.

At the present juncture the farmer naturally asks not how much potash is locked up in the rocks and minerals, but how out of these abundant sources he can procure potash for his potato, turnip, and other crops in the case of soils with little "available" and low total potash. In the first place, the possibility of obtaining potash from New Zealand sources may be briefly discussed under the headings of—(1) Wood-ashes, &c.; (2) seaweed; (3) soluble potash salts; (4) insoluble potash minerals and potash-bearing rocks; and (5) miscellaneous sources of potash.

(1.) *Wood-ashes.*—In past years the clearing and burning of our forests, wasteful in timber as it was, temporarily increased the fertility of the soil by providing a good supply of potash and other inorganic constituents necessary for plant-growth. The potash thus added to the soil, being for the most part in the form of the carbonate, was soon dissolved by rain-water, and much of it was carried away to the streams without being given a chance of entering into organic combinations. This *Journal* for July, 1915, contains an article by Mr. B. C. Aston† giving analyses of New Zealand wood-ashes. These, as indicated by Mr. Aston, vary greatly in potash-content, and further investigation of the subject is more than desirable—it is a pressing necessity if intelligent use is to be made of the potash stored in the forests that still remain to New Zealand. In general, young shoots and hard or dense slow-growing woods contain more potash than the average. It is known that rata-ash in particular is rich in potash. Immense quantities of sawdust are yearly produced at New Zealand timber-mills. This is either washed into streams or stacked in some convenient locality, and it has been suggested that potash could be profitably extracted from the ashes formed by burning it, together with the waste timber, bark, &c. Mr. Aston‡ and Professor F. P. Worley§ state that, in their opinion, a better plan would be to apply the ashes

* Report of Chemistry Division, Annual Report New Zealand Department of Agriculture, 1908, p. 247. See also "Wire-basket Method of Testing Soils," Bulletin No. 2, Chemistry Division, New Zealand Department of Agriculture, and various other reports by Mr. Aston.

† "Potash and the Great War." See also articles by the same author entitled "Potash in Agriculture," in the October, 1915, and December, 1916, issues of the *Journal*.

‡ "Potash in Agriculture," October, 1915, p. 284.

§ See *New Zealand Herald*, Auckland, 12th October, 1916, under the heading of "Supply of Potash."

direct to the soil, and thus to utilize also the phosphate and lime that are constituents of wood-ashes. Among materials high in potash may be mentioned potato-parings, cabbage-leaves, banana-skins, grape-skins, vine-stems, sunflower-stalks, bracken fern, and hedge-trimmings (broom and gorse).

(2.) *Seaweed.*—The different species of seaweed—also called kelp, though the latter name more correctly refers to the ashes of burnt seaweed—contain considerable but varying amounts of potash and other valuable constituents, such as phosphoric pentoxide ("phosphoric acid") and nitrogen. According to a well-known mining journal—the *Mining and Scientific Press*, of San Francisco—dried seaweed contains ordinarily about 15 per cent. potash, 2 per cent. nitrogen, and 1·5 per cent. of phosphoric pentoxide. The total fertilizing-value is estimated as £3 13s. 4d. per ton, and the cost of production is given as £1 17s. 10d. per ton. At present potash-prices a much higher value could be given to the kelp, but even with the lower figures the manufacture of potash from seaweed-ash ought to become a flourishing industry. Unfortunately, however, seaweeds vary enormously in their potash-content. Even with one and the same species there appears to be great variation,* according to the locality in which the sample is collected and other factors that have not been determined.

(3.) *Soluble Potash Salts.*—Soluble potash salts are formed in quantity only when arid or semi-arid climate prevails. They may then accumulate in the soil, or in the waters of lakes having no outlet. Possibly there are places in Central Otago where the soil, as in portions of India, &c., contains an appreciable amount of nitre, but one is tolerably safe in saying that even if present it cannot be economically extracted. Nowhere at the present day are the geological conditions in New Zealand favourable for the accumulation of soluble salts, and a similar state of affairs seems to have prevailed throughout past ages: that is, in the geological record we nowhere have evidence of ancient salt lakes, or of arms of the sea having been cut off from the ocean and subjected to desiccation; or, in fact, any record of a dry climate, except that in a not very remote period steppe conditions prevailed over a considerable portion of the present area of New Zealand, and perhaps over a larger area now submerged beneath the sea.† It is therefore

* See Aston, B. C., "Potash in Agriculture," this *Journal*, December, 1916, pp. 447 *et seq.*; and Winterbottom, D. C., "Potash," part of Bulletin No. 2, Department of Chemistry, South Australia, 1916, pp. 12–14.

† See, for example, Speight, R., "The Post-glacial Climate of Canterbury," Trans. N.Z. Inst., Vol. 43, 1911, pp. 410, 417; and Cockayne, L., "Notes on the Subalpine Scrub of Mount Fyffe," Trans. N.Z. Inst., Vol. 38, 1906, p. 417.

evident that the possibility of workable deposits of soluble potash salts *being found in* New Zealand is extremely small, and therefore that it would be a waste of time and energy to make a search for such material.

(4.) *Insoluble Potash Minerals and Potash-bearing Rocks.* — For some years strenuous efforts have been made to obtain potash in commercial quantity from those rocks and minerals in which it occurs as a prominent constituent. There is no great difficulty from a chemical point of view in separating the potash, and at present prices no financial hindrance; but the crux of the problem has been, and after the termination of the present war will again be, how to compete successfully with the German article. It is well known that before the war the latter was sold in foreign countries at prices far above the cost of production, and therefore after the war competitors can easily be crushed in any open market by a lowering of the price for a short length of time.

The most promising mineral source of potash is alunite, and a plant for its production from that source erected by the Mineral Products Corporation near Maryvale, Utah, has been in operation since September, 1915. In this plant the alunite, after being crushed by a rock-breaker and rolls, is mixed with powdered coal and roasted in a rotary kiln. The calcined material is digested in water, and potassium sulphate dissolves out. After being separated from the insoluble residue of alumina, &c., the solution is evaporated to near dryness in evaporation-pans. The resulting potassium-sulphate crystals are then separated out, drained, and dried.

In the case of feldspar or rocks high in potash-content a more complicated and expensive treatment has to be employed. A number of processes, the most noteworthy of which are those of Thompson and of Cushman and Coggeshall, have been proposed. Thompson's process "consists first of grinding feldspar rock so that it will pass through a 100-mesh sieve. The powdered rock is then mixed with an acid alkali sulphate and an alkali chloride, preferably acid sodium sulphate, 5 parts by weight; sodium chloride, 1·8 parts by weight. The mixture is heated from one to two hours at a bright-red heat, and becomes thereby partly fused. The mass is then allowed to cool, is ground again, and is leached with water, which removes a mixture of sulphates of potassium and sodium. These salts are then separated by crystallization. . . The yield of potash is ordinarily from 80 to 90 per cent. of the

potash in the rock. For the best results the temperature must be controlled within rather narrow limits."* The latest information concerning the production of potash from potash-bearing rocks is not of a very satisfactory character.

In New Zealand the known possible mineral sources of potash are the rock known as pegmatite, various volcanic rocks, and glauconitic greensands. Pegmatite is a variety of granite that consists of feldspar, quartz, and mica in very large crystals. Generally the feldspar is a potash feldspar, and when this is the case a product containing 10 to 12 per cent. of potash may be obtained by sorting out the coarser lumps of quartz from the broken rock. Dykes and masses of pegmatite occur on the west coast of the South Island and in Stewart Island. The volcanic rocks highest in potash-content are those that occur near Dunedin, but none of these appears to contain much over 7 per cent. of potash,† so that the outlook for producing that substance from them is not very bright. Glauconitic greensands occur in various parts of New Zealand—for example, near Dunedin (at Burnside), in North Canterbury (near Weka Pass, &c.), and in the Gisborne - East Cape district. Further reference to glauconitic rocks will be found in a later paragraph.

Here may also be mentioned some highly micaceous rocks that occur on the west coast of the South Island. In the gneissose rocks of the Paparoa Range, south of Westport, bands locally 20 ft. in thickness and consisting almost wholly of biotite in soft flexible scales frequently occur. Specimens of a somewhat similar rock, but composed mainly of white mica or muscovite have been found near Taipo, North Westland. No analyses of these mica-rocks are available, but they occur in such situations that their value as potash-sources may be considered negligible.

(5.) *Miscellaneous Sources of Potash.*—In the manufacture of cement much of the potash in the ingredients is volatilized during the calcining part of the process. In some cases the dust that collects in the flues contains a considerable percentage of potash, and the recovery of the latter is not only a feasible operation, but has actually been undertaken by one concern, the Riverside Portland

* Phalen, W. C., "Potash Salts," Mineral Resources of the United States, Part II, subpart 7, 1914, p. 101. The processes proposed by Morse and Sargent, by Gelleri, Hart, Bassett, and Cowles, are described in the same publication, pp. 98–101 For a description of Cushman and Coggeshall's process, and also of Thompson's process, see "Report on Mining Operations in the Province of Quebec during the year 1914," published in 1915, pp. 84–86.

† See analyses given by Dr. P. Marshall in his paper, "The Geology of Dunedin Trans. Zealand)," Quart. Journ. Geol. Soc., Vol. 62, 1906, pp. 381–424.
Subalpin

Cement Company, California. This company uses instead of clay as one of the cement ingredients a decomposed feldspar containing a considerable amount of potash. The volatilized potash is condensed with the dust by an electrical method known as the Cottrell precipitation process.* It is known that other classes of flue-dust also contain appreciable amounts of potash, and in some cases these could be applied direct to the land as fertilizing-material.

Some ores that are treated for their metallic contents contain a considerable amount of potash, and since the tailings in many cases are not only in a pulverized form, but are accessible to transportation facilities and to supplies of electric power, water, &c., the recovery of potash from such cheap material seems a possibility. B. S. Butler shows that various copper-ores occurring in the United States contain from 3·44 to 9·62 per cent. of potash, and that selected gold-ores contain from 1·68 to 13·36 per cent. of the same substance. Specimens from the De Lamar mining district, Idaho, are stated by W. Lindgren to contain as much as 14·95 and 15·12 per cent. of potash.†

CONCLUSION.

It will be observed that the chief ostensible object of this article, which was to indicate to the agriculturist where he could obtain supplies of potash, has not been fully attained from a practical point of view. Potash in inexhaustible quantity occurs in the rocks underlying every farm, but the situation is similar to that of the seaman adrift on the ocean: "Water, water everywhere, but not a drop to drink."

So much has been said about the use of lime in liberating potash for plant-food that it is unnecessary further to dwell upon the subject at the present time. In various parts of New Zealand it is possible for the farmer to add to the available potash-content of his soil by the application of soft rocks fairly high in potash. Some calcareous claystones, such as certain varieties of "papa" and the "blue bottom" of Westland miners, if applied as a dressing would confer a double benefit on the land through their lime and their potash content. Glauconitic rocks are likely to be of great benefit if applied in this way, for they contain an appreciable amount of phosphate as well as potash, and not

* Phalen, W. C., "Potash Salts: Summary for 1912." Mineral Resources of the United States, 1913, p. 903 (published by U.S. Geological Survey).

† The information in this paragraph is derived from B. S. Butler in U.S. Geological Survey Bulletin 620 J, "Potash in Certain Copper and Gold Ores," 1915.

infrequently lime in considerable amount. At Milburn, in Otago, glauconitic limestone—somewhat sandy, perhaps—is excluded from the limekilns. It is not unlikely that such stone, by reason of its potash and possible phosphate contents, small though these may be, is as valuable as the purer limestone selected for "burning." The point raised is well worth clearing up by means of complete analyses of carefully selected representative samples.

Few analyses of soft potash-bearing rocks likely to be useful as a soil-dressing are available, largely owing to the fact that in many cases soda and potash are not determined separately. It is probable that "blue bottom" claystone in many places carries 3 to 4 per cent. of potash, besides several per cent. of carbonate of lime. A specimen of "Kaiata mudstone" from Taylorville, near Greymouth, collected by the writer a few years ago was shown by analysis to contain 2·07 per cent. of potash, and about 10 per cent. of carbonate of lime.* A sample of calcareous mudstone from Buller Gorge, also collected by the writer, contained 2·16 per cent. of potash, and over 7 per cent. of carbonate of lime.† Analyses of claystone samples collected at Cape Foulwind show from 3·47 to 6·18 per cent. of alkalies, of which probably two-thirds may be considered potash, together with more or less carbonate of lime.‡ If these claystones were used in the manufacture of cement, as has been proposed, the recovery of potash from the flue-dust might be considered a practical operation.

Calcareous green sandstone (glauconitic) from Otoko, Gisborne district, yielded on analysis 1·98 per cent. of potash and over 28 per cent. of carbonate of lime.§ Other localities where highly glauconitic rock has been observed are Rakauroa (thirty-eight miles from Gisborne), and Whangara Island, north-east of Gisborne. No complete analyses of the highly glauconitic rocks of the Gisborne district are available, otherwise it is likely that some useful results would be disclosed. The same remark applies to the glauconitic greensands of North Canterbury. A greensand overlying the marl at Burnside, near Dunedin, contains small phosphatic concretions, and, apart from these, yields 3·35 per cent. of phosphatic anhydride, together with 4·12 per cent. of potash.‖ There can be no doubt that some of the land in the neighbourhood would be benefited by an application of the greensand as a dressing, either with or without the addition of the marl, which contains a tolerably

* N.Z. Geol. Survey Bulletin No. 13, 1911, p. 95. † N.Z. Geol. Survey Bulletin No. 17, 1915, p. 129. ‡ N.Z. Geol. Survey Bulletin No. 17, 1915, p. 129, and Dominion Laboratory Reports there cited. § Dominion Laboratory Report No. 49, 1916, p. 20. ‖ Ninth Annual Report, N.Z. Geological Survey, 1915 (published as part of parliamentary paper C.-2), p. 97.

high percentage of carbonate of lime, and has been used in the manufacture of cement.

A greensand with numerous shells of Brachiopoda outcrops on the beach near Seacliff, twenty-four miles by rail north of Dunedin, but being at the foot of a steep high cliff is hardly in a workable position.

Although it is unlikely that New Zealand will ever be a producer of potash salts for export, there is no reason for fearing a potash famine if at any time foreign sources should be cut off. Potash may be extracted from wood-ashes, seaweed, and wool-grease, and, as a last resource, from the unlimited supply locked up in rocks of almost every kind.

TABLE SHOWING IMPORTS OF POTASSIUM SALTS AND ALLIED MATERIALS INTO NEW ZEALAND DURING THE YEARS 1913–16.

Items.	1913.		1914.		1915.		1916.	
	Quantity.	Value.	Quantity.	Value.	Quantity	Value.	Quantity	Value.
	Tons.	£	Tons.	£	Tons.	£	Tons.	£
Alum (including aluminium sulphate)	200·75	1,334	203·65	1,207	150·15	1,177	293·45	2,410
Cyanide of potassium and cyanide of sodium	295·00	25,482	470·00	40,972	432·00	42,652	433·00	44,294
Potash not otherwise enumerated, pearlash, caustic potash	58·40	1,664	35·35	1,072	46·65	1,645	4·85	1,131
Saltpetre (including nitrate of potash, not manure)	81·70	1,973	60·55	1,701	77·40	2,754	152·95	6,777
Manures—								
Kainit	2,143·00	7,190	2,472·00	8,537	3·00	46	1·00	35
Muriate of potash ..	*26·00*	311	*23·00*	*273*	..	..	..	..
Sulphate of potash ..	1,009·00	12,130	1,529·00	18,775	92·00	2,342	..	..
Potash manures of other kinds (including bisulphate of potash and nitrate of potash manures	845·00	4,951	1,238·00	7,020	*	2	9·00	359

* Not stated; very small.

SHALLOW and indifferent cultivation may result in the production of fair crops in seasons having a sufficient rainfall, but cultivation of such a nature must inevitably result either in failure or reduced yields during seasons of light rainfall. In all districts likely to be visited by short periods of drought an endeavour should be made to increase the average depth of tilled soil, to plough early so that the soil may readily become saturated to its full depth by the spring rains, and to better the method of cultivation so that the moisture may be retained within the soil for as long a period as possible.—*G. de S. Baylis.*

CERTIFICATE-OF-RECORD COWS.

HIGHEST NEW ZEALAND MILK-RECORD.

W. M. SINGLETON, Assistant Director, Dairy Division.

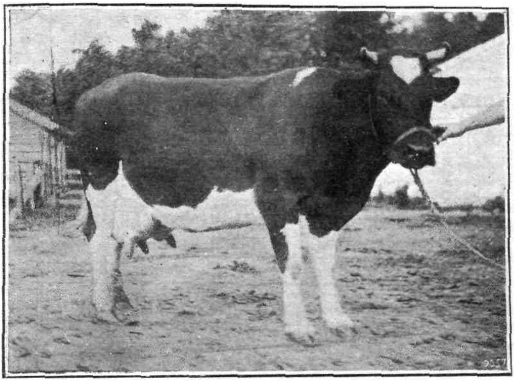
SALMA JOHANNA LYONS AND THE NEW RECORD.

IN some countries where dairying forms one of the principal lines of vocation of the rural community the standards of production required of purebred cows in qualifying for certificates of record include a minimum for milk-production as well as for butter-fat. Although in New Zealand productions of all cows, whether purebred or crossbred, are better understood in terms of butter-fat than in terms relating to the quantity of milk yielded, the quantities of milk produced by our highest-yielding cows are a matter of special interest.

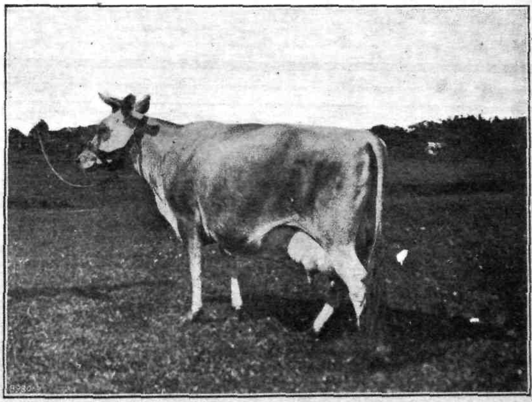
Among these yields, that of Salma Johanna Lyons, owned and tested by Mr. W. Barton, of Featherston, amounting to 21,439·81 lb., now stands pre-eminent in the Dominion. It is gratifying to note that this milk-record of Salma's is accompanied by a butter-fat record of 730·19 lb., which places her as the leader of the senior four-year-old Friesians. In this class she displaces Grace Fayne of Ashlynn, who produced 716·05 lb. butter-fat; while Salma's milk-production displaces that of Manola, who produced at the Department's experimental farm, Weraroa, 20,753 lb. The next highest record to Manola's is that of Holland Queen, with a credit of 20,629·9 lb. milk.

This record of Salma Johanna Lyons represents consistent work. During her preceding lactation period she was in test as a senior three-year-old, and produced 17,406·4 lb. milk, containing 560·47 lb. butter-fat. Calving again in six weeks, she has now produced the record which designates her the producer of New Zealand's highest milk-yield and leader of the senior four-year-old Friesians on butter-fat yield.

Salma Johanna Lyons was imported from Wisconsin by Mr. Barton. Her sire is Greenwood Johanna Lyons, who has also sired in America three other daughters with yearly records. One at two years yielded 606 lb., and two three-year-olds produced



SALMA JOHANNA LYONS.
Holder of the New Zealand milk-record.



SULTAN'S LASS.

509 lb. and 501 lb. butter-fat respectively. The dam of Greenwood Johanna Lyons is by a brother of Finderne Pride Johanna Rue, who produced 1,176·47 lb. butter-fat, and was world's champion until defeated by Duchess Skylark Ormsby. The dam of Salma Johanna Lyons has a yearly record, and her sire is by a brother of the sire of Finderne Pride Johanna Rue, referred to above. Our New Zealand champion milk-producer is therefore the result of a certain amount of line-breeding which represents the concentration of one of the best strains of the breed.

The latest sensation in North American short records is Segis Johanna Fayne, credited with 40·54 lb. fat in seven days. The dam of Segis Johanna Fayne is a daughter of Johanna Rue III Lad. This bull is also sire of Finderne Pride Johanna Rue, referred to above. While we in New Zealand do not place supreme importance on these short tests, this record certainly reflects credit on one of the principal ancestors of Salma Johanna Lyons. It may be mentioned that the sire of the new weekly champion, Segis Johanna Fayne, is also sire of Woodcrest Ida Fayne, one of the Friesians selected by the writer in the United States for the Department's farm at Weraroa.

SULTAN'S LASS.

Sultan's Lass, bred by Mr. A. E. Watkins and tested by Mr. H. L. Spence, finished her record in September, 1916, placing to her credit the fine production of 580·4 lb. fat. In order of merit in the Jersey four-year-old class this places her second only to Lady Collingwood. The illustration shows a cow of capacity. Her depth of body and udder-development are indications of production that could scarcely fail to impress a novice.

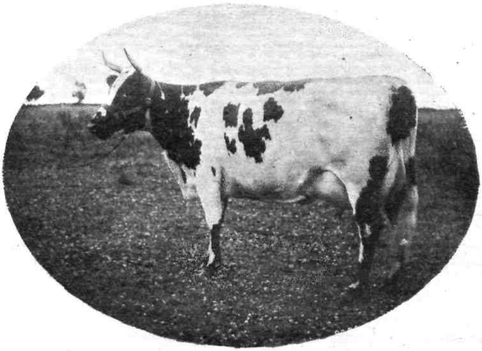
This cow, through her two granddams, is descended from some of the good early strains of New Zealand. Her sire's dam is a daughter of Cute Cicero and Mamy II. Mamy II was from Mamy I, a cow tested by Mr. E. Griffiths during the 1912–13 season, when she yielded 514·92 lb. fat. On her dam's side Sultan's Lass traces twice to each of two of her progenitors, Eileen (imported) and Cicero VI. Her two grandsires are Campanile's Sultan, with six C.O.R. daughters, and Yankee Sweet, with two C.O.R. daughters. Both of these grandsires were imported, and have a considerable number of descendants amongst New Zealand Jersey herds.

KANADALE LINDA.

This young Ayrshire represents a type that will appeal to lovers of good dairy cattle. Her outlines evidence capacity for milk-production, while her udder-development, both fore and back,

leaves little to be desired. It is claimed that she represents a breed of perfect udders, but it must be admitted that not all Ayrshire females measure up to Kanadale Linda's standard of excellence in this respect.

Messrs. Cockburn Bros., of Mataura, who bred and tested this cow, have for some years been interested in the C.O.R. testing of their favourite breed, and have placed on record some very good productions by members of their herd. Amongst these is the record of Kanadale Whitelets, the dam of Kanadale Linda.



KANADALE LINDA.

Whitelets was not forced, and had herd conditions, with the usual twice-a-day milking. In 363 days she yielded 10,400·5 lb. milk, containing 467·83 lb. fat.

Kanadale Linda's record for 365 days, commencing as a senior two-year-old, is 12,583 lb. milk, containing 502·55 lb. fat, and places her as leader of the two-year-old class. This i crease on her dam's record evidences an improvement, which must in part be attributed to good breeding. This young cow was sired by an imported bull bred in Scotland by Mr. T. Clement.

The poultryman who stints his fowls of food would be better employed at some other occupation.

OUTDOOR CULTURE OF THE GRAPE-VINE IN NEW ZEALAND.

(Continued.)

S. F. ANDERSON, Vine and Wine Instructor.

DRAINING THE VINEYARD.

FROM what was stated previously regarding the selection of site it will have been seen that a naturally well-drained position should be chosen for the vineyard. There is, however, always some draining to be done—if not to carry the soakage and underground waters, it may be to prevent the washing-down of the loose cultivated soil from slopes. In the latter case the drains really perform the office of traps, catching the soil and allowing the water to flow past. Such a drain running across the face of a slope should be almost level, the outlet being at any V-shaped formation of the slope, natural or artificial. The size of this V would depend on the area of catchment above the vineyard as well as the distance through the vineyard to the bottom of the slope and the final get-away of the water. The sides of the drain should be well sloped, and its capacity ample for any rush of water likely to occur. Being well sloped into the bottom of the V would permit of the sides being readily kept clear of weeds. The number of drains across the face of the vineyard would depend on the distance from top to bottom of the latter; about one drain in every chain would be sufficient. In the case of a natural soakage at the foot of the slope, which often occurs, it would be wise not to plant such a place, or, at all events, not until its condition could be properly controlled.

The drainage of flat land should be effected by means of 3 in. tiles running into open drains at the sides or ends of the vineyard, if that can be managed; but if the distance be more than 3 to 4 chains, traps must be put into the drains to catch any soil being carried through them, and also for the purpose of ascertaining if they are working satisfactorily. It will perhaps be better to show the method of doing this by referring to the plan of the vineyard given in the February *Journal*, page 114 (Fig. 3). It is assumed that the vineyard as laid out on this plan has a general fall to the front. After heavy rains on a flat cultivated area,

unless there is proper get-away for the water, it must follow on ordinary soils that there is more or less consolidation, according to their texture, such as clayey, loamy, gravelly, or sandy. If it should be a clayey loam, then underground draining with tile pipes should be carried out. An inch of rainfall on 10 acres is equivalent to 36,300 cubic feet of water, or 226,350 gallons. It is a common thing to get that in a night or twenty-four hours. If the soil has been cultivated as suggested in the section on the preparation of the land, the rain can penetrate to that depth, enriching the soil with the ammonia and nitric acid that is brought with it. If the land is not well drained the water that cannot soak through evaporates, leaving the land colder and in an unhealthy condition for the vines.

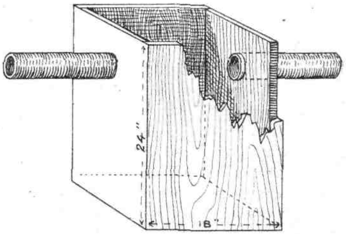


FIG. 27. BOX TRAP FOR TILE DRAINS.

It is suggested that six drains be dug as shown on the plan, one through the centre of each plot, with another on either side, 1 chain away. The top drains are led into traps in the centre road, and then flow out of these traps through the lower plots, emptying into a main drain along the front. They are all to be underground drains, not less than 3 ft. deep (or they might get filled with roots of the vines), and laid with 3 in. tiles. They should have a fall of at least 1 in. in every 18 ft., or a total fall in 10 chains of 37 in., though a little more would be better. On the other hand, with too much fall they are liable to burst up through the ground after heavy rain. The traps should be made of some good material, such as concrete or totara timber; 18 in. square and 24 in. deep has been found a convenient size (see Fig. 27). The water flowing in from the pipe on the higher side, and out again on the lower, deposits in the box any

soil washed down. The cover of the trap must fit close over the top, and yet be easily removable for inspection. Traps must be placed well below the working-depth of any of the vineyard implements. The final outlets should be into an open drain with a good get-away for the water. The drainage of the reserve for buildings, shown on the plan, and the boundary drains, have not been included, as only local conditions can decide such requirements.

It is perhaps unnecessary to impress on the well-informed cultivator the great importance of thorough drainage. The advantages of draining may, however, be stated as follows: It (1) removes stagnant water; (2) raises the temperature of the soil by admitting air; (3) renders stiff clay and retentive soils porous; (4) improves working-conditions of soil; (5) makes for healthier and warmer atmospheric conditions; (6) gives better control over weed-growth; (7) reduces cost of cultivation; (8) ensures better crops; (9) improves the capillary action, drawing moisture to the roots from below during dry seasons.

MANURING THE VINEYARD.

The benefit to be obtained by ploughing in green crops on all vineyard lands cannot be overrated. For this purpose horse-beans come first, then scarlet clover, peas, vetches, mustard, rye-corn, &c. They should be grown until they come into flower if possible, and then be ploughed in. By using a short chain with a weight at the end, such as an old sash-weight or ball from a steelyard, attached and tied to the beam in front of the mouldboard of the plough, the green stuff can be gathered and turned in perfectly.

Where stable manure can be obtained it is one of the best manures. No chance should be lost of obtaining it, provided the cost of carriage is not prohibitive. A stack of it can be started at any time, and as each lot is carted in it should be packed closely by treading, and covered with a layer of 5 in. or 6 in. of soil. If left about in loose heaps and open to all weather it loses much of its value and becomes little better than litter. Where stable manure can be applied to the vineyard green-manuring is not required. Stable manure is not to be recommended where vines are not on phylloxera-resistant stocks, as it tends to make the soil lighter and easier for the pest to spread in.

In some situations a good top-dressing of rich soil from a swamp or foot of a slope can be given with much benefit to land poor in humus. Nitrogen is better applied in the form of green-manuring or blood and bone. In the manuring of vines, what the grower requires is the maintenance and, in some cases, the restoration of a standard of growth.

Nitrate of soda has been proved to be one of the most profitable fertilizers known in connection with vine-growing, provided it is drilled in to a depth of 5 in. or 6 in. Once applied, nitrate of soda should always be used; nevertheless, it must be employed judiciously on account of its extremely stimulating effect. By judicious application it has increased grape-production in Australia so much that its use has there become general. The scientific viticulturists in that country have attained phenomenal results from its use, without at any time impairing the vigour of the vine through forcing such abundant cropping. In 1905 the average yield of grapes in South Australia, which is the principal vine-growing State in Australia, was under 15 cwt. to the acre From 1905 to 1913 the average increased to 2½ tons. This was principally due to the application of nitrate of soda, in some cases in conjunction with other fertilizers, and combined in all cases with the more modern systems of scientific pruning and cultivation. So far the extra cropping has not weakened the vines; on the contrary, the vineyards there have never been better as regards stability and productiveness.

Phosphatic manures may be used, according to soil conditions (which will be indicated in the next section), either in the form of superphosphate or basic slag. Should basic slag be unobtainable owing to the war, lime and superphosphate or basic superphosphate may be used instead. Bonedust and blood and bone can be applied with great benefit to any vineyard requiring a stimulant.

An endeavour has been made above to supply a general outline of the plant-food required by the vine. In no case should manure be given to the vineyard in greater quantity than is applied to general farm crops. The object should be to maintain an average rather than a heavy crop.

It may be added that the benefits of liming in its various forms apply in general to vineyards as to other branches of culture, the special conditions being taken into account in each case.

The general luxuriant growth of the vine in very dry years compared with that made by other plants indicates how much the vine derives from the atmosphere.

SOIL-REQUIREMENTS IN THE PRINCIPAL VINE-GROWING DISTRICTS.

Gravelly soils such as are found in Hawke's Bay require lime, superphosphate, potash, and green-manuring to keep them up in condition, more particularly those on hillsides. A good dressing of wood-ashes from timber-mills is beneficial, provided, of course, that the ashes have not been long exposed to the weather beforehand,

as heavy rain will wash out the potash. Superphosphate should be used to supply the phosphoric acid in this drier portion of the North Island. Slag requires a more even rainfall in order to get the full benefit from it.

Fairly heavy clay soils that have been covered with heavy bush are generally good, and the vine makes a strong growth in them. It would not be necessary for some three or four years to manure land where such growth is made. Good cultivation keeps restoring the soil, so that the vine is amply supplied with fresh particles of plant-food. Should the soil be well supplied with humus and inclined to go together, possibly a dressing of lime would be beneficial.

In order that growers may better understand the nature and requirements of some of the typical Auckland soils, information given in various reports of Mr. B. C. Aston, Chemist to the Department, are here reproduced, as follows:—

Stiff Clays.—Examples, Te Kauwhata Horticultural Station soils. These are characterized by a large quantity of clay-particles, a high percentage of available potash, and almost entire deficiency of available phosphoric acid, but having a fairly high total phosphoric-acid content. Soluble potash manures act as a poison to plants on these soils, and when applied to any crop invariably decrease the yield. Lime and phosphates, particularly alkaline phosphates such as basic slag, give highly increased returns, the yield of grass over an unmanured plot being twenty-five-fold in the second and third years after application of 10 cwt. basic slag per acre. Some of the unavailable phosphoric acid speedily becomes available with tillage. The rational treatment of these soils should aim at unlocking the dormant plant-food and improving the adverse physical conditions by applications of lime, by tillage, and by increasing the store of humus.

Clays and Fine Sandy Clays. — Example, Whangarei gum lands. These are very poor soils, characterized by an almost entire deficiency of total and available phosphoric acid; they are low in total and available potash and in all other plant-food, thus differing from the previous type (Te Kauwhata clays), which have an abundance of unavailable plant-food, and which may ultimately become available. The proper treatment of the Whangarei gum-land soils must resolve itself into (1) an attempt to liberate more plant-food from the unavailable state in which it exists, (2) the addition of suitable phosphatic manures, (3) the improvement of the mechanical state of the soil by supplying humus and subsoiling to allow deep-rooting plants to search for food, (4) the selection of suitable crops and grasses. The excellent results of carbonate of lime in large dressings on the poor gum lands extending north from Albany have been shown by the Department's experiments at that place with crude calcareous marl.

Clays.—Example, Waipoua Forest (Hokianga County) clay soils, containing, for virgin soils, a very fair amount of plant-food.

Fine Sandy Loams.—Example, Ruakura (Hamilton) Experimental Farm soils. These are fine sandy loams, evidently originally deposited by the Waikato or some other river. The soils of this farm vary very much in composition, those of the hilly parts being richer in organic matter than those of the flats, probably owing to the deposition of silt on the low-lying land subsequent to the elevation of the hilly parts from the Piako Swamp. The typical soil is characterized by the presence of a large quantity of fine sand and silt (50 to 60 per cent.). These soils respond readily to drainage and cultivation, the low percentage of phosphoric acid speedily increasing with tillage. The amount of available potash is generally high.

Coarse Sandy Soils.—Example, Rotorua pumiceous soils. These are derived from acidic volcanic rocks, largely air-borne, and are comparatively recently formed. The most characteristic quality of these soils is their pumiceous sandy nature and their excellent natural drainage. They vary greatly in chemical composition, especially in the content of available phosphoric acid, but all show an excessive amount of acid constituents, chiefly silica, and a deficiency of lime carbonate. Improvement would probably be effected by ploughing in green crops and by application of phosphatic fertilizers, of which superphosphate is likely to prove the most efficacious, used in conjunction with basic slag. Clovers grow exceedingly well on all these soils.

Fine Sandy Soils.—These are characterized by the presence of a large quantity of fine sand. They are usually deficient, or contain traces only, of available phosphoric acid.

Humus and Peaty Soils. — Examples, various Waikato and other drained swamps. These are characterized by an excessive amount of organic matter (decaying vegetable matter), and are usually found on the sites of old swamps which have been naturally or artificially drained. These soils are always rich in nitrogen, and some are rich in mineral plant-food, notably those which have been enriched by burning at the surface, such as the Aratapu soil. The Te Puke drained-swamp land is deficient in available phosphoric acid, and would probably benefit by applications of basic slag for all crops. The drainage of this swamp is facilitated by the occurrence at different depths of layers of pumice-dust from Tarawera and possibly other volcanoes. As soon as the main drains are cut the water flows off rapidly, and excellent turnips can be at once grown with the aid of a little phosphatic manure. A sample from the Hamilton end of the Piako Swamp is deficient in potash and phosphoric acid, but contains a considerable amount of other mineral nutrients. This soil should respond well to phosphates and potash. A sample from Clevedon is another soil which has been enriched by burning. Waipoua Forest furnishes a leaf-mould which is very rich in available plant-food. From Te Rapa (Waikato) comes a sample of peaty soil, 3 ft. 6 in. in depth, which is entirely deficient in available potash, a character which most peaty soils unmixed with mineral matter (clay, &c.) share. Available phosphoric acid is present in good quantity. Probably the soil could be much improved by the addition of clay or by judicious burning. Eureka (Waikato) furnishes a very open black fine sandy humus soil, on which manuring turnips with 1½ cwt. Island guano and ½ cwt. sulphate of potash proved most successful in 1908, notwithstanding the unfavourable nature of that season owing to the prevalence of blight

VINEYARD PESTS.

Fungoid and insect pests are, fortunately, not numerous in the open vineyard, and can all be controlled perhaps better in New Zealand than in other countries.

Phylloxera is confined now to a few places in the far north of the Dominion, and need not be there did the growers take advantage of the resistant grafted vines available from the Department's horticultural stations and some private nurserymen.

Black-spot (Sphaceloma ampelinum).—This fungoid disease gives most trouble in the northern vineyards—that is, north of Gisborne. The first intimation of the presence of the fungus is the appearance on the leaves, young shoots, and berries of small circular black spots. These gradually spread till after a time they cause the leaves and fruit to shrivel and drop off. The young wood is also very liable to be damaged. Small sunken oval areas appear, and these lie along the shoot as shown in Fig. 28. The cuts give an excellent representation of both berries and wood, rendering more detailed description unnecessary, except to say that when the complaint is more advanced the spots on the berries become much larger than those in the drawings.

The remedy is Bordeaux mixture. Apply in winter, using the following formula: 10 lb. sulphate of copper, 10 lb. fresh roche lime, and 40 gallons of water. Dissolve the 10 lb. sulphate of copper in 20 gallons of water; slake the 10 lb. lime slowly, and make up to 20 gallons; strain this milk of lime into the solution of sulphate of copper, stirring briskly. The solution should be used within eight hours of mixing, otherwise its value as a fungicide is largely depreciated. For summer use, prepare in the same way, but using 4 lb. sulphate of copper, 5 lb. fresh roche lime, and 50 gallons water. Sulphate of copper may be dissolved by tying it in a piece of sacking and suspending overnight just below the surface of the water, or by using hot water. Vessels of wood or earthenware should be used. To be thoroughly effective the spraying of the Bordeaux mixture must be well done. No part of the stem and rods should be missed, as the resting spores are on every part of the plant. The fungus cannot vegetate if covered with a layer of this mixture. This treatment is certainly not a cure, but only partially checks the spread of the disease.

The following remedy, if applied carefully and properly, has been known (and the writer is personally acquainted with several instances) to absolutely eliminate black-spot for three or four years: This is the application of a 10-per-cent. solution of sulphuric acid, painted on the buds and cuts immediately after

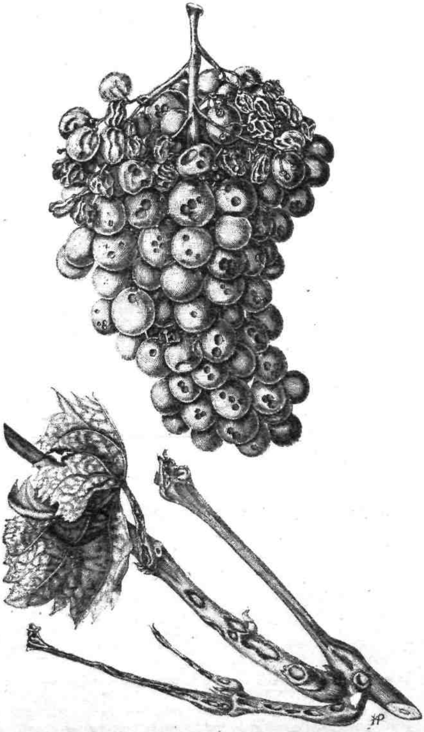


FIG. 28. BLACK-SPOT OF VINE (*Sphaceloma ampelinum*).
Bunch of grapes and young wood, both showing effects of disease.

[*From nature T. W. Kirk.*

pruning. Sulphuric acid is a chemical that must be used with care, otherwise great damage may be done. The grower must first of all be certain that the sap has quite receded. The remedy must only be applied when the vines are absolutely dormant, and in all cases within three or four hours of pruning. Finally, one must be sure that he paints the vine carefully all over. Black-spot was once a dreaded disease amongst the vign.rons of France, but the difficulty has been practically entirely overcome through the use of the foregoing corrective method.

Mildew (Oidium Tuckerii).—This is a fungoid growth upon the young leaves and fruit, and is general wherever vines are grown. It has the appearance of dirty-white, powdery, web-like threads overspreading the tips of the young shoots and in round patches on the under-side of the leaves. It vegetates very rapidly, especially in damp muggy weather when the wind is from the east. From a few specks it will in the course of a few days overrun a vineyard. There is seldom a season in which vines grown in the open are not affected to some extent. To counteract mildew the winter formula of the Bordeaux mixture should be applied to all vines outdoor, and this in a measure checks the trouble.

Sulphur, however, is the chief remedy. It should be dusted over the vines as soon as the shoots are a few inches long, and at intervals throughout the growing season, according to weather conditions. The best method of applying the sulphur is with the Vermorel sulphurator; 5 acres a day can be done with one of them. An economical and effective method generally used in Australia in applying sulphur is as follows: The sulphur is placed on the centre of a piece of fine hessian about 3 ft. square. The corners of the hessian are gathered up into one hand, and the sulphur is shaken through on to the vine. This leaves one hand free to open up the vines if necessary, enabling the operator to dust the foliage thoroughly.

Latterly the method of atomic sulphur spraying has come into practice, and has been used with marked success at the Arataki Horticultural Station. The proper proportion for application to vines is 12 lb. atomic sulphur to 100 gallons water—rain-water if possible.

Vine - caterpillar (Albina vockiana Bragato and *Thyridopteryx Herrichii* Blunno*)*.—This insect causes trouble at times among the grape-vines by getting into the fruit, spinning a web among them, and eating the stems of the berries. It is to be found when the berries are about half-grown. The remedy is arsenate of lead. Spray with 1½ lb. of the lead to 50 gallons of water. This will soon rid the vines of the pest.

Mealy Bug—the greatest pest in the cultivation of vines under glass—is not a serious trouble in the vineyard. An occasional vine growing near other plants in a garden may become infested, especially if it is trained against a wall. It is by general neglect in pruning and cleaning that the insect is allowed to gain a footing. One of the best remedies in such case is after pruning to remove all rough scaly bark and syringe with hot water. The plant will stand water quite hot enough to kill insects and eggs. That the mealy bug will thrive outdoor in our climate we have abundant proof, but the method of pruning the vine generally followed removes so much of the wood, leaving that remaining exposed for nearly four months, that the insect is probably then killed. Mealy bug requires more or less cover to thrive. So little does mealy bug affect vineyard work that it is not mentioned as a pest in any of the works on outdoor viticulture.

THE BIRD NUISANCE.

More troublesome at present than any fungoid or insect pests in the vineyard are birds—particularly the blackbird, thrush, and white-eye, and in Hawke's Bay the minah as well as the first three. Nothing short of netting the fruit in some form affords entire protection against them. Shooting from dawn to late evening is partial protection; it does not keep off the white-eyes.

An Efficient Bird-scarer.—In the circumstances indicated a simple and effective mechanical device for scaring the bird marauders is of great value. The scarer here described and illustrated has, to the writer's personal knowledge, proved its efficiency.* It consists, briefly, of a bright kerosene or benzine tin containing marbles, mounted on an axle, and revolved by wind-power—the "scaring" factors thus being rattling noise and flashing light. Very little wind keeps the tin moving. As it becomes rusty it should be replaced by a bright one. With care, however, a tin should last for a season or two. Following is a detailed description of the scarer, to be read in reference to Fig. 29 on next page.

The frame (A) consists of a piece of 4 in. by 2 in. timber, 3 ft. long, placed horizontally, into which is let two uprights (*a*, *a*) of 2 in. by 2 in. to stand 12 in. above top edge of the 4 in. by 2 in. piece, 16 in. apart. Two inches from the top of the right-hand a hole (*b*) is bored ½ in. in diameter and 1½ in. deep. It should not go through—the ½ in. left forming a stop for the axle. The left-hand upright has a hole (*b*) bored through it at the same height as that on the right. A saw-cut is then made down to the hole in the latter and a piece

* A model may be seen at the office of the Horticulture Division of the Department, Customs Building, Wellington.

cut out to allow of the axle being put down into it. The axle is kept from jumping out by a pin or nail (*c*) put through just above it. The 4 in. by 2 in. horizontal forms the support, and swings on *the top of a* $\frac{3}{4}$ *in. iron rod, a hole being bored through at* (*d*) *for* that purpose. A small iron plate is screwed on top side to form a stop (*d*). On to the 4 in. by 2 in. piece is nailed the tail (*e*), a piece of thin board 6 in. by $\frac{1}{2}$ in. or 9 in. by $\frac{1}{2}$ in.—3 ft. long. Or a narrower board may be used with pieces of bright tin cut from a

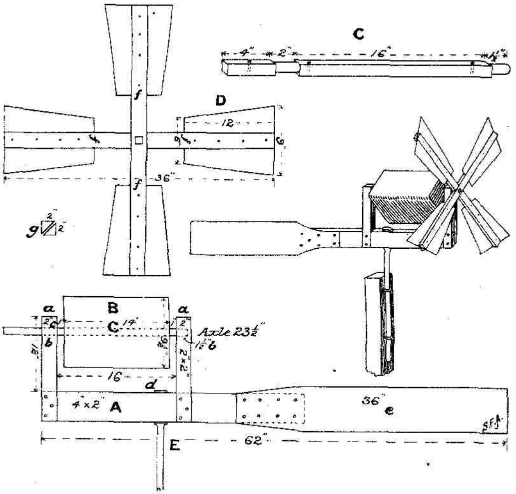


FIG. 29 A BIRD-SCARER FOR THE VINEYARD.

kerosene-tin tacked on to it. This forms an additional scare by the flashing in every movement.

The tin (B) is an ordinary kerosene or benzine tin, 14 in. by 9½ in. by 9½ in. All the preparation this requires is a square hole cut in each end for the axle. The work should be neatly done to fit the axle without any play. Before putting the axle through place a few marbles in the tin.

The axle (C) may be made of hardwood 1 in. square, rounded at the parts where it revolves in the uprights (*a, a*), or of $\frac{3}{4}$ in. iron.

soon

The axle is 23½ in. long. The projecting end that carries the sails is square and 4 in. long; the next 2 in. is rounded; the main part is square and 16 in. long; and the end (1½ in.) is rounded to work in socket. The tin being 14 in. long, 1 in. is allowed at each end of the axle to allow of it revolving clear of the uprights. Pin-holes must be bored 1 in. in from the end of the 16 in. centre part to allow of pins being put through to keep the tin in its place; also a pin-hole through the projecting 4 in. to prevent the frame of the sails going on too far.

The sails (D) are formed of two pieces of 2 in. by 2 in. timber, each 3 ft. long, let into one another. Before fastening these together a saw-cut is put in from the points down to part marked (*f*) on frame, from corner to corner, to give the bevel necessary for resisting the wind (see *g*). The blades or sails can be cut from four sides of a bright kerosene-tin. These are slipped into the saw-cut, and are held in place by light nails run through.

The support (E) is a rod of ⅝ in. round iron, on which the scarer is mounted and swings to the wind. It should be of sufficient length to permit of it being stapled or otherwise fastened to a fencing-post high enough to clear the head.

The utility of this scarer is, of course, not confined to vineyards. It could also be used in orchards, grainfields, &c.

TABLE GRAPES.

The table varieties of grapes grown outdoor in those parts of the North Island where the conditions are favourable for ripening are the American vines Albany Surprise, Isabella, Le Noir, McPike, Allen's Hybrid, and Iona. These varieties have been well proved. They should all be grown on the natural or chaintre methods, described earlier in this article. The European varieties suitable are Black Hamburg, Muscat Hambro, and Golden Chasselas. Those doing well in Hawke's Bay in addition to the foregoing are Chasselas Rose, Temperano, Favourita, Besgano-Nero. All these can be grown on the espalier system.

The system of growing table grapes does not differ in general from that described for wine grapes. The following method of training the fruiting-shoots of the European varieties of table grapes, introduced by a well-known Hawke's Bay grower, may, however, be recommended to vine-growers: Working on the ordinary double Guyot system of an espalier fence of three wires, that method is improved on by having a cross-piece or stretcher of wood about 2 in. by 2 in. and 12 in. long nailed to the post 21 in. above the

level of the soil. *The cross-piece is fixed so that half of its* length projects on the side on which the vine is growing, as shown in the illustration (Fig. 30). In carrying out this method two middle wires are used in place of the single wire usually employed—one at each end of the cross-piece. The fruiting-rod is trained to the bottom wire in the ordinary way, and as the shoots bearing the fruit grow up they are tied alternately to the wires on either side of the cross-piece, each shoot sloping outward. The advantages of this method are that there is no crowding of *the shoots, while the facility in* tying, spraying, and sulphuring is increased; it is also an easy matter to select the best bunch to each shoot and cut the secondary ones away, as every one hangs clear but at the same time well protected by the foliage. This is a *consideration in growing* table grapes. The most important advantage of the method is that the fruit, hanging clear of the foliage, can dry rapidly in showery seasons. If the bottom wire is kept 9 in. from the ground and the cross-piece 1 ft. above that, small-meshed wire netting to keep off the birds could be used.

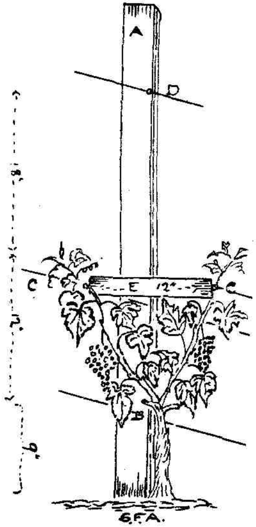


FIG. 30. METHOD OF TRAINING FOR TABLE GRAPES (END VIEW).

A, post; B, bottom wire; C, C, two wires on same level stapled one to each end of stretcher; D, top wire for training rods; E, stretcher or cross-piece.

The appearance of the fruit for the table may be improved by spending a little labour in allowing only one bunch to each shoot, tying the shoots here and there where required to get best position. In the case of a choice crop of Black Hamburg a certain amount of thinning might be done. As a rule, however, it does not pay to thin outdoor grapes.

In sending grapes to the market they should be packed in the schooner grape-box. *The sizes of the different pieces required for*

this box are as follows: Tops and bottoms, four pieces each 18 in. by 6 in. by ⅜ in.; sides, two pieces each 18 in. by 4½ in. by ⅜ in.; ends, two pieces each 12 in. by 4⅜ in. by ⅜ in. The box when put together holds about 15 lb. When packing lay the grapes in evenly and fill up a little above the level of the box, so that after tacking down one end a little pressure is required to tack the other end of lid. The grapes shake together before reaching the sale-room, hence the necessity for firm packing.

ESTIMATED COST OF ESTABLISHING A VINEYARD.

In establishing a vineyard on commercial lines the area decided on should be such as would justify the employment of a regular staff, a team to work the land, the most up-to-date implements for tillage, and labour-saving machinery. Ten acres would probably be the least that would do this. The initial cost could be spread over three to four years. The expenses would occur in the following order: (1) Purchase of the land; (2) clearing of scrub; (3) ploughing and subsoiling; (4) boundary-fencing; (5) shelter-planting; (6) drainage; (7) disk-ploughing, harrowing, and levelling; (8) marking off and planting vines; (9) erection of shed for implements, stable, &c.; (10) erection of vine-trellises; (11) erection of winemaking buildings and providing winemaking plant; (12) team of two horses.

The schedule that follows does not include purchase of implements, tools, buildings, and winemaking plant, nor team of horses. It is assumed that the site selected is within a reasonable distance of a railway or good waterway; and that it is second-class scrub land, undulating, and naturally well drained, and accessible by a good road. The cost figures must be taken as approximate only, and subject to war conditions.

	£	s.	d.
Cost of 10 acres of uncleared second-class scrub land at, say, £10 per acre	100	0	0
Clearing and burning at £1 per acre	10	0	0
Ploughing and subsoiling at £1 10s. per acre	15	0	0
Disk-ploughing, harrowing, and levelling after six months fallow at £1 per acre	10	0	0
Draining 60 chains 3 ft. deep	37	2	6

NOTE.—To every 6 ft. in length of an excavation 30 in. wide on the top, 6 in. wide at the bottom, and 36 in. deep there is a cubic yard of soil and clay. 30 + 6 = 36; 36 ÷ 2 = 18; and 18 × 36 = 648. A cubic yard contains 46,656 cubic inches: therefore 46,656 ÷ 648 = 6 ft.; length of drain 60 chains = 3,960 ft.; 3,960 ÷ 6 = 660 cubic yards to be dug out. A man can dig 8 cubic yards of tough earth per day of eight hours. 660 ÷ 8 = 82½ days' work at 9s. per day.

	£	s.	d.
Draining-tiles, 3 in. diameter, 12 in. long; price in Auckland, £9 per 1,000; number required, 4,000	36	0	0
Railage, say, £10	10	0	0
Cartage and handling, 250 per load, ordinary dray; 16 loads at 5s.	4	0	0
Levelling floor of drains and laying tiles at 1s. 6d. per chain	4	10	0
Cutting, carting, and putting in layer of scrub on top of tiles at 1s. per chain	3	0	0
Filling in drains, 1 chain per hour; 1 man sixty hours at 9s. per day of eight hours, 7½ days	3	7	6
Six traps for drains: Timber (totara) 134 ft. 9 in. by 1 in. heart at 25s., £1 13s. 6d.; 54 ft. 3 in. by ½ in. for straps, 5s.; nails, 2s.; labour, making, 5s.; digging holes for fixing, 9s.	2	14	6
Number of vines required: 9 acres at 680 per acre = 6,120 at £2 per 100	122	8	0
Carriage and laying in	2	10	0
Marking off land for planting, buildings, drains, stakes, &c.; boundary fences and gates, 40 chains at 15s. per chain..	35	0	0
Gates, two at 25s. each	2	10	0
Vine espalier trellises:—			

NOTE.—These need not be put up for two years after planting. The young vines as they grow can be tied to temporary stakes to permit of cultivation being carried on. If the side headlands shown on the plan (Fig. 3) are made 16 ft. wide there will be the exact space for 38 vine-trellises 8 ft. apart on each side of the centre road, or 76 in all. The length of each will be 300 ft. to the centre cross-road and another 300 ft. in the lower blocks. There are therefore required—

	£	s.	d.
304 totara or puriri straining-posts, each 7 ft. 6 in. long and about 9 in. by 4 in., carefully picked for the work; cost, about £10 per 100	30	8	0
Intermediate posts, 33 ft. apart. These are 16 to the row. Requirements are therefore 76 × 16 = 1,216 7 ft. posts at £5 per 100	60	16	0

NOTE.—The cost of posts depends on locality; near timber country no doubt they could be obtained at a less cost.

	£	s.	d.
Stakes, 2 in. by 2 in. for use between the posts, 76 × 18 = 1,368, at 8d.	45	12	0
Labour erecting fences, 691 chains at 2s. 6d.	86	7	6
Wire for fences, four wires to each, galvanized No. 10, 3½ tons at £11 10s.	40	5	0
Temporary stakes for marking off and putting to vines, 2,000, 3 ft. long, 1 in. by 1 in., at 4s. 6d. per 100 ..	4	10	0
Contingencies	25	0	0
Total	£694	1	0

THE DEPLETED LANDS OF THE SOUTH ISLAND CENTRAL REGIONS.

W. J. McCULLOCH, Fields Supervisor, Invercargill.

FOR a number of years past the depleted arid pastoral country of certain inland regions of the South Island has been the subject of much interest and discussion both from an individual and national standpoint, for not only is it necessary to evolve a remedy for re-vegetating these large areas, but it is also quite as important that measures should be taken at once to check the further devastation of our useful native pastures on the very extensive tracts of similar adjoining country.

In dealing with this subject the writer would draw the attention of those concerned to the fact that undoubted evidence exists that, as a result of natural selection for centuries past, the vegetation now found in our native pastures is in many ways likely to be the best adapted to withstand the rigours of the naturally arid climate of the country in question. The fault of depletion cannot therefore be attributed to nature's selection, but rather to our abuse of such selection. My suggestion is, to put it briefly, that *practical pastoralists never attempt to replace the native grasses* where those are in abundance on a similar type of country, but are quite content to profit by nature's bounty, knowing from their practical experience that economically the position cannot be improved.

It will be understood that no reference whatever is here made to the very small proportion of country throughout these central regions capable of being cultivated from a practical and economic standpoint, as it is considered that small patches of this character in valley-bottoms can be treated successfully by ordinary farming practice suited to such conditions. The main train of thought should be directed to a study of the requirements of the much greater proportion of purely native pastoral country which has become depleted and is incapable of being economically cultivated.

Assuming, therefore, that after centuries of natural selection certain grasses have adapted themselves to the prevailing conditions, is it not practical to suggest that, although these grasses from abuse have seemed to disappear, we should assist the return of

what was once useful pasture, rather than that we should endeavour to replace them by attempting the establishment of grasses which have not yet been proved practical from an economic viewpoint?

CAUSES OF DEPLETION.

It is commonly agreed by authorities that the depletion of these lands can be traced as the effect of one or all of the following causes: (1) Indiscriminate burning, (2) overstocking, and (3) the rabbit pest.

On the greater portions of the lower faces, or winter country, for many years it has been the custom, as soon as the ground is sufficiently dry after winter, to fire the best of the natural vegetation, or, in other words, the heaviest and best of the tussock and grasses. As many settlers can verify, it was no unusual sight to see a fire devastating large tracts of country, burning day and night, probably for a number of days together. Often no thought was given as to where it might spread or finally burn out, with the result that vast tracts of fine tussock and native-grass country were subjected to annual destruction for the short-sighted gain of a few weeks' feed which was effected by the springing of the young tussock and grasses for a short period immediately after firing. Also, during summer, either accidentally or from motive, burning took place, sometimes started by musterers in signalling to one another, or by a match dropped carelessly during a dry spell.

No doubt in some cases firing takes place with the object of surface-sowing the burn with some of the valuable cultivated grasses and so improving a particular area, and there may be a certain amount of justification for such a course, especially if firing is confined to spots where it is assured better grasses will take and flourish; but, taking the bulk of country known to-day as "depleted lands," and where burning has helped as one of the causes to bring about this undesirable condition, it assuredly was not with any idea of permanently improving such land by surface-sowing that this destruction by fire took place, but merely to give the immediate effect of fresh young feed. This method may mean slight profit for a short time, but eventually spells depletion and ruin.

It is sometimes argued in support of this method that the tussock becomes so rank, with such an amount of dead and decaying vegetation, that the fine native grasses are crowded out, or that even the coarser tussock finally dies out as the result of such accumulation. This argument appears most unreasonable. If such were the case it would be natural to assume that the finer grasses

and tussock would have all disappeared centuries before our pioneers landed in New Zealand. Instead of this, the old settlers recall the vast seas of waving nutritious vegetation on the lower mountain-faces, valleys, and plains, which are now dreary nude wastes, dotted sparsely with a lowly form of plant-life known as scab-weed, or mountain-sheep (*Raoulia lutescens*). In passing, it should be noted that this form of plant-growth is nature's slow but sure method of reasserting herself by the accumulation and replenishment of the depleted humus necessary for a higher form of vegetation.

A further argument in favour of burning is that if such measures were not adopted there would be greater danger from an accidental fire sweeping the country in large areas. Admitting that such would be the case, why not protect the country by carefully burning annually, in suitable weather, a number of fire-breaks under proper control? It is a poor argument to suggest wholesale destruction of native pastures for the sole reason of avoiding the emergency of accidental fire.

Overstocking has undoubtedly been another great factor in assisting depletion. Many runs to-day are carrying stock in numbers above their proper carrying-capacity, even although the total stocking now is much below former years. As time goes on and depletion spreads, or becomes more pronounced, the stock is decreased, but only because it becomes absolutely compulsory, not from any other motive, so that no relief is given in this direction. In support of this contention as to forced decreasing of stock through the depletion of the land the record is given below of the Galloway Station, in Central Otago, the area of which was at the time some 129,000 acres, and which up to that date had not been encroached upon to any appreciable extent by farm settlements. The station carried as follows:—

Year.	Sheep.	Year.	Sheep.
1879	75,000	1904	20,973
1887	66,000	1906	25,228
1893	55,910	1909	27,732
1899	31,600	1910	27,231
1902	26,143		

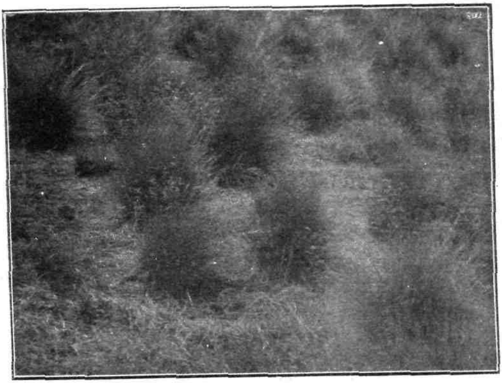
In the early days of the rabbit pest, and before the destruction of rabbits was as well understood as it is to-day, very grave harm was done to the native herbage in certain parts of what is now depleted country. The rabbit is particularly fond of dry, warm country, with its characteristic sweet, nutritious pastures; and, being an animal endowed with the capacity for feeding closely the plants it selects, it literally eats out by the roots many of the most

valuable grasses, thus assisting depletion in no small degree, both by its gnawing habit, mischievous uprooting of the soil, and poisoning of the land by excessive manuring. Regarding the effect of rabbits in such country, a case is recalled where a settler bought an area in Central Otago. This land was carrying a flock of twelve thousand sheep, principally ewes, which usually gave a lambing of about 60 per cent. Immediately after purchasing he took steps to decrease the rabbits, with the result that the following year his flock had increased to fifteen thousand, with a lambing of 80 per cent., and this during a season when climatic conditions were not any more favourable than in preceding years. To have increased the flock may appear simple, but the lambing increase showed that the ewes were not lacking in milk, which indicated that feed was plentiful.

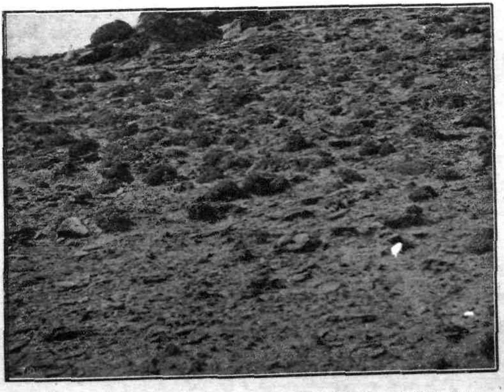
THE NATIVE PASTURE AND ITS REGENERATION.

The depleted country was previously thickly grassed with many varieties of useful native pasture plants, among which are silver-tussock (*Poa caespitosa*); hard tussock (*Festuca rubra*); blue-tussock (*Poa Colensoi*); red-tussock (*Danthonia flavescens*); blue-grass (*Agropyron scabrum*); the native oat-grasses (*Danthonia semiannularis* and *Danthonia pilosa*); plume-grass (*Dicholachne crinita*).

The tussock-grasses afforded a fair amount of nutritious feed, especially when in seed, as did also the other grasses mentioned, blue-tussock being very nutritious and palatable; but the great advantage of the taller and coarser-growing varieties was the shelter afforded by them to one another and the finer grasses growing between, also in assisting to conserve moisture and thus creating a humid condition. So soon as the taller and more robust tussock is destroyed by fire the sun and the fury of every drying gale is allowed full play, moisture is dried out, and eventually the finer native grasses disappear also. The source of supply of humus which nature provides by the decay of plant-life, and without which no soil can remain fertile or productive, is removed, and thus the soil becomes lighter than before and less retentive of moisture. Finally the hillsides become devoid of the roots which hold the soil in position, as what little rain falls, together with the contraction and expansion caused by frost, gradually denudes the country of soil, washing and blowing to lower levels that which nature has probably taken centuries to form. Overstocking and neglect to control the rabbit have eventually the same effect. One has only to consider the fate of cultivated grass lands when stocked too heavily. Even under good treatment most of our grass fields require lifting periodically and sowing down afresh;



NATIVE GRASSES IN AN ENCLOSED UNBURNT AREA, CENTRAL OTAGO.



DEPLETED LAND IN CENTRAL OTAGO, SHOWING DEAD TUSSOCKS, ETC.

but, unfortunately, it cannot be hoped to economically treat the bulk of the depleted lands to cultivation in this way. Yet if we cannot cultivate and artificially renew the pasture on hill country we can at least assist the naturally selected grasses to renew themselves by maturing and sowing their seed as they were in the habit of doing before the advent of stocking.

Another point which should be noted is that the native grasses were never subjected to grazing previous to the advent of the first settlers, as there were no native herbivorous animals; and, although a selection was made by nature in regard to climatic conditions, it cannot be assumed that it was a survival of the fittest from a grazing point of view. Naturally, when the settlers stocked the land they assumed that the native pastures, which for some years afterwards continued luxuriant, were capable of carrying and being eaten down by stock to the same extent as the grasses they knew better; hence the grasses were overstocked, and no provision was made for renewing them.

Looking at the problem from a practical viewpoint one is forced to the conclusion that the salvation of the depleted lands, or those tending in this direction, lies in deferred rotation grazing, or the shutting-up of portions of each run annually at certain seasons of the year, in order to permit of the best grasses maturing and dropping their seeds and so perpetuating themselves. So far the writer is not acquainted with any particular case where systematic spelling of country with this object in view has been effected, or where seeding of the native herbage has intentionally been encouraged on any considerable scale by the settler. It has often been observed in Central Otago, however, where small areas on portions of depleted country have been enclosed for fruit orchards or other purposes, and where, often as a convenience, a fence-line may include a strip of depleted hill-face not intended to be cultivated, how surprisingly soon some of the native vegetation reasserts itself after spelling. It may at some future date be considered advisable to detail a scientifically trained man for the sole study of the subject. Observation and investigation of the habits of the grasses should be carried out with a view of discovering the best method of protection and perpetuation combined with the most profitable system of grazing. This would, of course, entail the practical and economical management of an area stocked with sheep. I feel assured there is room for much scientific and practical research in solving the problem.

Another phase of the subject which might be worthy of some consideration in attempting to assist the re-establishment of the natural grasses is the planting of extensive shelter-belts, for it is

quite evident that so long as the drying winds sweep across these barren wastes unchecked the present position will be aggravated. Extensive tree-planting has, I think, much to recommend it, for it is commonly acknowledged that where forests occur humidity is increased, and thus the attraction for a better rainfall is encouraged. Then, again, extensive plantations would be a valuable national asset in the future. This, together with the effect of shelter and the attraction and conservation of moisture, should be sufficient inducement to encourage extensive afforestation in these regions.

AMERICAN DEPLETION INVESTIGATIONS.

It should be noted that the problem of depletion is not peculiar to portions of New Zealand. In parts of America the same difficulty presents itself on what is commonly called range country, which is similar to what is known in New Zealand as run country. There the depletion of range lands has been the subject of extensive scientific and practical research. The problem there is greater than here, on account of the more varied altitudes at which depletion occurs.

The following notes are culled from the *Journal of Agricultural Research*, published by the United States Department of Agriculture, and in the main agree with the principal suggestions already outlined in this article. The studies were undertaken by the Forest Service in co-operation with the Bureau of Plant Industry during the spring of 1907 in the Wallowa Mountains of north-eastern Oregon. The principle followed in this investigation was in the direction of assisting perpetuation of the natural herbage rather than the introduction of alien grasses. The purely experimental studies were continued throughout the seasons of 1907, 1908, 1909, and 1910, and were followed by a practical application of the principles evolved to run-management on lands within the Wallowa and National Forest. It should be explained that the national forest in the United States is not necessarily heavy-timber country, many thousands of acres being open pastoral country. The system evolved as a result of these studies—a combination of deferred and rotation grazing—is now being applied, with minor variations, to run lands throughout the national forests, and promises to be of the greatest value in bringing about the efficient utilization of the forage resources. The altitude of this country is from 3,000 ft. to 9,500 ft., and the character and distribution of the vegetation is classified into four different zones. The rainfall in the lowest regions is about 17 in. annually, gradually becoming heavier as the altitude increases and the air-temperature decreases. It was found that the growth requirements of run-plants

could best be determined by a study of individual species and the factors with which they have to contend from the time that they begin growth in the spring, through the various stages of development to seed-maturity, and then on to the permanent establishment and seed-bearing stage of the vegetation produced from seed of the original plants. The essential features of this almost double life-cycle are—(1) Inception of growth; (2) flower-stalk production; (3) development and maturity of seed; (4) viability of the seed crop; (5) establishment of reproduction.

The vigour of the vegetation, and consequently the time and abundance of flower-stalk production, is also strongly influenced by the way the pastures are grazed. Close cropping, or, in other words, overstocking prior to the full development of the plant, delays not only the flower-stalk production, but also the maturing of the seed crop in subsequent years. The period required for an overgrazed plant to regain its vigour depends on the amount of injury received and the situation in which it grows. Three seasons of protection from grazing are usually sufficient for herbaceous vegetation to recover its vigour fully. During the first year (1907) no difference was observed in the time of flower-stalk production on the protected and open runs, since the vegetation on both had previously been weakened through grazing. In 1908 and 1909, however, there was a notable difference in flower-stalk production between the protected and the grazed lands. Early and abundant production of flower-stalks is of the utmost importance in seed-production, and plants with low vitality are likely to produce flower-stalks so late that the seed has no time to mature. Elevation is, of course, influential in determining the time of seed-maturity. Each increase of 1,000 ft., other conditions remaining the same, brings about the approximate delay of a week in maturity. The chief factor in determining the time of seed-maturity, however, as well as the size of the seed crop, is the vigour of the vegetation. Where the herbage has been closely grazed for several successive seasons when green, and the vitality of the vegetation thus lowered, no seed was produced, or else the period of maturity came so late as to be seriously interfered with by frosts and low temperature. In contrast to this, the seed-ripening period on the year-long protected lands and on those not grazed until after seed-maturity (deferred grazing) was much earlier and more uniform, while the amount of seed produced was notably better. On the unprotected runs (pasture grazed all the year) there was little difference in the time of seed-maturity from year to year. On both the year-long protected runs (no grazing) and that grazed after seed-maturity (deferred grazing), however, the period came

earlier each successive season in direct ratio with the increase and the vigour of the vegetation.

These most interesting studies point to the conclusion that if the native grasses were left undisturbed until the seed had ripened, at which time the plants would have ceased growing, they may produce as large and as early a seed crop the following year as would vegetation on blocks not grazed at all. There is, therefore, no need to spell a block of country the year round, as the same result may be obtained by a system of combined deferred rotation grazing. Clearly these facts are of the utmost importance in devising an economic system by which the native grasses may become re-established.

The following were the conclusions arrived at by the American investigators :—

1. Even under the most favourable conditions the viability of the seed on runs grazed all the season is relatively low.

2. Removal of the herbage year after year during the early part of the growing season weakens the plants, delays the resumption of growth and time of flowering, and decreases the seed-production and the fertility of the seed.

3. Under the practice of year-long grazing, both the growth of the plants and seed-production are seriously interfered with. A run so used, when stocked to its fullest capacity (overstocked), finally becomes denuded of vegetation.

4. Deferred grazing ensures the planting of the seed crop by trampling (to some extent) and permanent establishment of seedling plants without altogether sacrificing the season's forage.

5. After the first area selected has been revegetated it may be grazed at the usual time, and another area set aside for deferred grazing. This plan of rotation from one area to another should be continued even after the entire run has been revegetated, in order to maintain the vigour of the grasses and to allow the production of an occasional seed crop.

CONCLUSION.

The remarks and suggestions in these notes are made with a view of creating intelligent interest not only in the re-establishment of the native pastures on depleted country, but also as regards the proper care and perpetuation of the best grasses on similar types of country which are tending towards this unfortunate condition. It should be realized that the subject is of national importance and demands strong measures. When after thorough investigation a definite method or system has been evolved it may be considered advisable to legislate in the direction of controlling the carrying-

capacity of the country in question, with the object of protecting it against any unscrupulous short-sighted treatment. In this connection the conditions of leases, rents, &c., would have to be considered, but this side of the question cannot here be dealt with. The writer is confident, however, that the effective re-establishment of the once luxuriant native pastures would amply repay careful scientific research.

INTENSIVE DAIRYING IN AUSTRALIA.

J. R. MACDONALD.

THE bulk of the land for a considerable radius around Sydney, New South Wales, is not of a class suited to pasture dairying, the soil generally being inferior. But the metropolitan population of some 800,000 creates a demand for a large quantity of dairy-products, and the manner in which much of the supply is forthcoming is novel and interesting. The requirements are met by means of an intensive or artificial scheme of dairying of a pronounced type. There are several such dairy farms in the environs of Sydney, and as the population of any suburb becomes congested these dairies advance farther out.

Half an hour's journey from the centre of the metropolis took the writer to the farm herein described, the electric cars passing but 100 yards from its gate. The area is confined to some 3 acres in all. Most of it is taken up with home buildings and garden, and with cow, milking, and food-storage sheds, the only yard or run for the animals consisting of less than 1 acre.

One hundred cows comprise the herd, the Shorthorn blood being most prominent. Milking begins at 2 a.m. and 11 a.m. The cows are driven from the yard to the milking-shed, where an up-to-date plant of New Zealand manufacture performs the task to the satisfaction of the owner. As the cows are released from the machine they make their way into the feeding-shed, where they line up in a long double row of stalls, facing one another at the feed-box, extending three parts the length of the shed, the farther end of which is used as the feed-preparing department, standing adjacent to the food-storage sheds.

The milking and feeding take the owner and his two assistants three hours. After about an hour at their meal the cows are liberated to the small outside yard, where a plentiful supply of water is always available. The yard leans at a desirable slope towards a mass of rock and stone, terminating in a declivity

and making the drainage good. All the surroundings are hygienic —indeed, scrupulously clean.

The milking-shed is concreted on the floor, and the walls are tiled. The feeding-shed has concrete for a floor, and sawdust is strewn in both sheds as a precaution against the cows slipping and falling. The milk is conveyed from the milking-shed to the milk-storeroom by means of an automatic releaser. After passing over the refrigerator it remains in a brightly clean vessel or tank in a cool atmosphere until required for the forenoon or afternoon retail delivery, which the owner carries on.

The food supplied to the herd consists of a mash of maize-corn, from which the starch had been separated at the mill, and bran and lucerne or ordinary chaff, mixed and heated. The cows are fed at the rate of one bucketful each of this mixture, together with as much lucerne hay as they can eat. Lucerne is grown very largely in Australia.

The production of milk runs to 9 and sometimes 10 quarts from each cow per day—say, 10 per cent. higher than a similar average obtained from good pasture grazing. Under this system of dairying, milking is continuous the year throughout. The cows are veritably turned into milk-machines; nevertheless many of the animals remain in the herd for three years. When they show signs of failing production they are replaced by other and younger stock. Such, however, is the condition-making nature of their feed that when they are disposed of they are practically ready for the butcher, and command a substantial price accordingly. The health of the animals is good, as a look at them indicates. Sometimes Epsom salts are given, but the food is of such a balanced nature that, with an abundance of good water, health is well maintained.

The owner states that a cold-weather spell is always accompanied by a decline in milk-yield, which shows that the temperature rule applies to this hothouse system of dairying as well as pasture grazing. He also instances a peculiarity of the bovine race—at least, under the conditions in question: if one of the herd falls down the other cows will, if chance permits, surround it and gore it to death. Otherwise the members of the herd live on terms of reasonable amity one with the other.

The payableness of this system of dairying is substantial. Where the dairyman is familiar with stock and produce markets great savings may be effected in buying at favourable opportunities —say, when fodder is at a low price, and when there is ample accommodation to store supplies for perhaps several months ahead;

LUCERNE AT MOUMAHAKI.

During the past twelve months lucerne has again demonstrated its great value at the Moumahaki Experimental Farm, the period including the late extremely dry summer. Useful experience has also been gained in grazing the stands.

In the North Island lucerne has hitherto been regarded almost entirely as a crop for the production of hay or green fodder. This practice entails cutting and carting to live-stock, processes involving a considerable amount of labour; hence the desirability of utilizing the crop to greater economical advantage. In order to demonstrate that lucerne can be successfully used for grazing all kinds of live-stock, the paddocks at Moumahaki were stocked at intervals throughout the year. Ewes and lambs, wethers, bullocks, cows and calves, mares and foals—in fact, all stock to be found on a farm—were grazed on the lucerne for various periods without causing any apparent injury to the plants. During September and November heavy bullocks were grazed, the longest period being for twenty-four days. The stocking has been heavy, and all the animals have kept in splendid condition, while there has also not been one sick beast.

As showing the wonderful carrying-capacity of lucerne, it may be mentioned that one field of 14 acres which was mown for hay on the 2nd March, 1916, during the following twelve months kept the equivalent of ten sheep per acre, and in addition yielded a hay crop of 2 tons per acre in January, 1917. In calculating the number of sheep thus carried it is estimated that one grown beast is equal to six sheep.

Although the total rainfall at Moumahaki for January, February, and March amounted to only 3·83 in., the lucerne on the farm is still growing well and carrying a good number of sheep and cattle.—*T. W. Lonsdale, Manager, Moumahaki Experimental Farm.*

The area of lucerne at the Department's poultry-station at Milton, Otago, illustrated in the frontispiece of this issue, was sown in rows on the 11th October, 1916, and carefully kept clean of weeds during its establishment, a fine stand resulting. The first cut was made on the 8th January, 1917. The photograph was taken shortly before the second cut, six weeks later, when a growth of 30 in. had taken place.

FIELD-DAY AT THE RUAKURA APIARY.

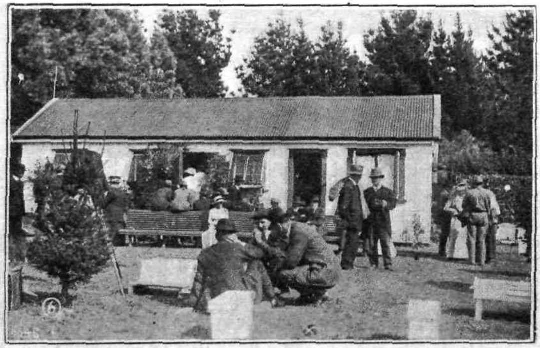
On the 14th February last about two hundred members and friends of the Waikato branch of the National Beekeepers' Association held their second annual field-day at the Ruakura Farm of Instruction. The gathering was a very representative one of the Auckland Province, and it was also pleasing to note that quite a sprinkling of those in attendance were Ruakura Apiary cadets of former years.

The visitors were welcomed by the Farm-manager, Mr. A. W. Green. Mr. T. W. Kirk, Director of the Horticulture Division of the Department (which now has the supervision of the Ruakura Apiary), speaking in regard to the many suggestions made at last year's gathering for the improvement of the apiary, mentioned that a number of these had been put into effect, and others would follow in due course. Various experiments had also been initiated, the results of which would be noted, and as faults and failings, as well as good points and successes, would be pointed out, the industry would gain probably almost as much from knowing what to avoid as by adopting what proved advantageous. Mr. Kirk pointed out that the Ruakura Apiary was carried on primarily for the double purpose of the training of cadets and the testing of various appliances and methods of management, and not for financial results. Mr. J. A. Young, M.P. for Waikato, spoke of the advantages of co-operation among beekeepers and the duty of the State to encourage industries. Mr. R. F. Bollard, M.P., also briefly addressed the gathering. Mr. J. S. Cotterell, president of the Waikato branch, touched on the good work of the Honey-producers' Association. He pointed out that the demand for New Zealand honey was constantly on the increase both here and in England, and that beekeepers should strain every nerve to increase the output, knowing that the market was sure and the field for both production and sale of the product was unlimited. In view of the large areas of good bee-country still unworked, a fine opportunity offered for the returned soldier to enter a pleasant and remunerative occupation.

Mr. A. B. Trythall, Apiarist in charge, then conducted the visitors through the apiary, explaining the work carried on, and detailing experiments in progress with six different kinds of hives. He also pointed out the advantage of asbestos slate as the foundation of a hive-stand, and illustrated various approved methods of laying out apiaries. Descriptions were given of the making-up of nuclei, and the various improvements in the honey-house, including steam-heated uncapping-knives, gravity strainers, easy bottling methods, and the latest appliances for making up hives and frames were also shown. The advantages and otherwise of using shallow honey-supers, wood-quilts, flat and gable roofs, hive-numbering, &c., were likewise pointed out. Of all the experimental hives dealt with, the Hand hive, containing the switch bottom-board and utilizing existing standard bodies and frames, was the one most recommended.

FIELD-DAY AT THE RUAKURA APIARY.

THE GATHERING IN THE APIARY.



VIEW SHOWING THE HONEY-HOUSE, ETC.

Mr. G. V. Westbrooke, Apiary Instructor for the district, gave a useful address on "American foul-brood and its cure" by the McEvoy treatment. Mr. S. W. Gilling, of Hawera, president of the Honey-producers' Association, spoke of the bright prospects of the industry, and pointed out that the demand for the honey was very far in excess of the supply; consequently prices were constantly rising, and it behoved beekeepers to endeavour to greatly increase their output. Mr. J. S. Cotterell gave an instructive address and demonstration on "How, by the use of queen-excluders, a laying-queen could be introduced to a colony already having virgin queens." An address was also given by Mr. C. S. Hutchinson, explaining how a number of queen-cells could be started by one colony and carried on to maturity in other hives in the course of a comparatively short time.

Later in the day the cadets demonstrated the handling of bees, the taking-off and the extracting of honey, and the use of various appliances. At the conclusion of the proceedings a number of questions were asked and answered by leading beekeepers, and a hearty vote of thanks was passed to the Manager and other farm officials for the facilities provided and the hospitality shown.

CONFERENCE OF LOCAL APIARY INSPECTORS.

Prior to the general meeting of the beekeepers a conference of the local honorary apiary inspectors for the Auckland Province was held in the class-room at the Ruakura Farm of Instruction. Mr. T. W. Kirk, the Director of the Horticulture Division, who presided, welcomed the inspectors, and thanked them for the good work they were doing in assisting the Inspector for the district. He thought that by getting them together it would help them to gain uniformity in the methods of inspection. Although they gave their services in an honorary capacity, he hoped they would ultimately gain by helping to rid their districts of disease. Mr. Westbrooke, the Apiary Instructor and Inspector for the Auckland District, also gave a short address, and explained the methods of inspection work adopted by the officers of the Department, advocating patience and tact in dealing with beginners. After a general discussion departmental officers and local inspectors adjourned to the general gathering at the farm apiary. The following local inspectors were present at the conference: Messrs. Millett, Papakura; Willis, Franklin; Sage, Ohaupo; Davies, Waikato; Luke, Whakatane; Black, Waimana; Schmidt, Thames Valley; Housler, Netherton.

The British Minister of Munitions announced recently that an agricultural-machinery branch had been set up in conjunction with the Board of Agriculture and the Food Controller, to deal with the control of the manufacture of agricultural machinery and implements in the United Kingdom. It is intended to class the manufacture of all such machinery and implements as munitions work. An advisory committee of representatives of the agricultural-machinery trade generally and the Government Departments concerned has been established to advise the branch.

WORK FOR THE COMING MONTH.

THE ORCHARD.

J. A. CAMPBELL, Assistant Director, Horticulture Division.

As every experienced orchardist is aware, the spray-pump cannot be long out of commission at any season of the year; therefore the short period of rest referred to in last month's notes will soon be at an end. Before the end of the month autumn spraying will be well under way, but there is still ample time to allow of a thorough overhauling to be given to the spraying machinery. This is a wise precaution to take, and any reasonable opportunity of carrying it out once or twice a year should not be missed. A little care of this kind in season may avoid serious loss, and, while the whole success of spraying depends upon the thoroughness with which the work is done, this in turn very largely depends on the efficiency of the spraying outfit.

In the majority of districts the work of pruning and spraying stone-fruits will soon be commenced. These ope ations, owing to the increase in fungus diseases and San Jose scale, have now become a matter of considerable importance.

BROWN-ROT AND ITS CONTROL.

Brown-rot, or ripe-rot (*Monilia fructigena*), is the main offender in the fungus class, as its ravages during the past two or three seasons have put the others, bad as we thought they were, entirely into the shade. Brown-rot is credited with being easily the worst stone-fruit disease in America, and, judging by our comparatively brief experience of it, there appears to be little doubt of it sustaining its American reputation in this country. Unfortunately, up to the present, although a good many experiments have been carried out, there has been no system of control devised that can be altogether relied upon to ensure complete immunity from attacks of brown-rot. This, however, does not mean that spraying is altogether ineffective. On the contrary, up to a certain point spraying is quite effective if properly carried out, but there are other factors that must be taken into account which tend more or less to rob spraying of a fully effective result.

The chief among these factors relates to the manner in which this and other fungus diseases are spread. Almost every one is to some extent familiar with the manner in which the well-known fungus disease of Irish blight (*Phytophthora infestans*) spreads throughout the potato crop of a district when climatic conditions are favourable. One diseased crop—or, for that matter, a few diseased plants in a district—may be sufficient to contaminate the whole. When the disease develops, the air becomes charged with myriads of spores from the affected plants; the spores are carried by the winds to other crops in the locality, and so on, until the whole district becomes affected. Under such circumstances a clean crop is likely to prove of little value unless definite steps are taken to keep it clean—steps which necessitate the keeping of each plant coated with a fungicide during the danger period.

Exactly the same conditions apply to brown-rot. The disease is carried over from season to season by means of previously affected trees, fruit, and foliage, and is spread in exactly the same manner as Irish blight. An orchard may be sufficiently well sprayed during the dormant season to ensure freedom from the disease were it not for infection from an outside source. This position therefore suggests, as in the case of potato-blight, some form of summer treatment, a sufficient number of neglected or indifferently sprayed orchards to give the disease a start being sure to exist in any district.

Summer spraying of stone-fruits, however, is not altogether devoid of difficulties. The tender nature of the foliage of such trees, particularly that of the peach and nectarine, is such that only comparatively weak mixtures can be used with safety; besides which, in the case of the peach, the downy coating on the skin of the fruit, whilst being an excellent medium for the collection of floating spores, renders spraying more or less ineffective unless applied at a high pressure. Another factor—and the principal one to the fruitgrower—which must be taken into consideration in th control of this disease is the cost of spraying as compared with th market value of the fruit. The price of stone-fruits for severa years past has not been sufficient to allow of any great additio to the cost of production. In this connection, however, judgin by the past two seasons, there is little doubt that the price o reliable fruit—that is, fruit which is not likely to rot right awa in the hands of the buyer—must go up. In this way the per severing grower may be well compensated for his extra labour.

To summarize the matter of the control of brown-rot, the follow ing is recommended: Prune the trees as early as possible in th

autumn, and thoroughly spray them with either 8-6-40 Bordeaux or lime-sulphur 1 in 15. Rake up and burn all old leaves, mummified fruit, and prunings; plough the ground, and thoroughly turn under all remaining rubbish and surface soil that was exposed during the season. Spray with 8-6-40 Bordeaux when the buds begin to swell. Thin the crop well, and spray about the time the earlier fruits begin to swell. Spray again the later varieties about a fortnight or three weeks later, using lime-sulphur 1 in 130 or 140, or 2-3-50 Bordeaux. Even these weak mixtures when applied at a high pressure may result in slight scorching, but the risk will have to be taken, a high pressure being necessary in all cases.

SAN JOSE SCALE.

San Jose scale is the most prolific and destructive of all orchard insect pests, and, while being one of the easiest to destroy, it is one of the most difficult to eradicate. The following is the reason for this apparent paradox: The insects increase in millions during the year, owing to which any small number of insects that escape the spraying are sufficient to set up the infection practically to the same extent as previously. To thoroughly reach the whole of these minute pests is extremely difficult. Careless spraying, which results in the tips of branches and other parts of the tree being missed, can and should be avoided; but the insect is often to be found in numbers secreted under coarse bark and in crevices of the tree, where to reach it becomes a much more difficult matter. The scraping of trees to remove the rough bark is made compulsory in Tasmania in connection with the control of codlin-moth, and no doubt were the scraping of trees affected with scale practised here the difficulties of eradication would be greatly reduced.

San Jose scale is particularly destructive to stone-fruits, and, while it affects the tree and the fruit crop during the summer according to the degree of infection, the greatest amount of damage to the tree itself is done from the time the sap ceases to flow until the scale becomes dormant, which in a mild season is often well into the winter. During the growing season the tree has a chance of replacing the sap lost to the insects, and may therefore remain comparatively healthy-looking, but immediately root-action ceases the damage to the tree becomes much more serious. This accounts for dead limbs being found in the spring on trees which were more or less healthy in appearance at the end of the previous summer.

Owing to this danger it is necessary to check the ravages of the scale as early as possible in the autumn. To do this it is advisabl

to spray before pruning rather than allow the tree to be robbed while pruning operations are being completed. Emulsified oil is, of course, the most reliable spray for this class of insect, but, as it cannot be applied to peach-trees with safety so early, lime-sulphur 1 in 15 is preferable. Not only will lime-sulphur at this strength destroy the scale, but its fungicidal properties make it a useful spray for fungus diseases also.

ORCHARD PLANTING.

The commencement of the actual planting season will soon have arrived. The preparation of the land for planting, however, has in most cases been under way for some time. This matter will be dealt with more fully next month, but in the meantime I should like to refer once again to the absolute necessity of thoroughly preparing the land before planting. Neither time nor trouble should be spared in this direction. Work the soil deeply and thoroughly, and without doubt the trees will in the future compensate many times over for the extra expenditure. Similar remarks apply to the class of tree selected for planting. Insist on your nurseryman supplying nothing but the best, even if you have to pay more for them. Ten pounds extra per thousand for trees may at the first glance appear to be a serious consideration, but when further considered it will be found that this represents a fraction more than twopence per tree, and it therefore becomes of little moment so long as the dearer trees are really ten pounds per thousand better than the cheaper ones. Twopence per tree means the yield of two pounds of fruit extra per tree for one season only to cover the difference. It is therefore evident that the planting of the cheaper tree, if it is at all inferior, is unsound economy.

THE NATIONAL APPLE SHOW.

This show, the second of the kind held in New Zealand, which opens at Dunedin on the 1st May, is primarily intended to advertise and popularize the New-Zealand-grown apple. Incidentally, all profits accruing from the show will be devoted to patriotic purposes Therefore the joint objects of the show are highly commendable, and should appeal to the public and the fruitgrower alike. A considerable amount of labour is being undertaken by the manager and executive of the New Zealand Fruitgrowers' Federation, together with a local committee of Otago residents formed to assist. There is no doubt the show will be the best of its kind ever held in the Dominion, but in order to ensure the success anticipated by the management every orchardist who can possibly do so should make it his business to visit Dunedin during the first week of May.

POULTRY-KEEPING.

F. C. BROWN, Chief Poultry Instructor.

MAY is ordinarily one of the slackest months of the poultry calendar. It is therefore a good time in which to do all the odd jobs for which time cannot be spared at other periods of the year. There is a time for everything, and now is the best time to thoroughly clean up the plant and make preparations for the busier months. The bulk of the surplus cockerels, and the cull hens, having been disposed of, the plant will be carrying its minimum stock. There is no better opportunity to set about sweetening at least some of the runs. On all plants an endeavour should be made each year to dig up, lime, and sow down a sufficient area of ground to accommodate during the following season the young stock right through their growing stage. There are no stock that do so well as those that are reared on fresh clean soil. In fact, it is impossible for chickens to make the best growth if the only run provided is where adult hens have been running the previous season.

There are also other things that should be attended to now, such as draining wet runs, making houses really draught-proof, setting about the erection of new breeding quarters, making provision for extended brooding and hatching operations, or overhauling the incubators to make sure that the burners of the lamps and the regulators are in good working-order. The mending of gates, fences, &c., should also have attention. Such work done now will enable the necessary time to be devoted later on to the important work of hatching and brooding the new flock. The object of the poultry-keeper should be to prepare well ahead for the busier season; then the drudgery usually accompanying poultry-keeping will be largely eliminated from the business. Frequently cases come under my notice where poultrymen have failed to rear their chicks as successfully as they really knew how, simply because they had too much other work to attend to at the time, and consequently had to neglect the more important duties of rearing.

COLDS.

This is the period of the year when the birds are apt to contract colds, especially the young stock which have been late-hatched. Therefore a careful watch must be kept, and on any of the birds showing the first symptoms, such as sneezing, running at the nostrils, or eyes watering, they should be attended to at once and an endeavour made to find the cause. It should be remem-

bered that colds are the forerunner of roup, which is one of the most difficult diseases that the poultryman has to contend against, for if it once gets a good foothold the whole of the flock may become affected in a very short space of time. The most common causes of colds are exposure to rain and wind, and ill-ventilated or draughty houses; while damp, dirty, overcrowded quarters are often responsible. When fowls are observed to show any of the symptoms indicated put half a teaspoonful of Condy's crystals into a pint bottle of water, and as a rough measure add one dessert-spoonful of the mixture to about two quarts of the drinking-water three times a week, and on such days give no other water to drink. Should this treatment fail, take a shallow dish, or something similar, fill it with pure kerosene, and dip the bird's beak into this sufficiently deep to cover the nostrils. Hold the bird in this position until it breathes; this will have the effect of drawing the kerosene to the seat of the trouble. Repeat the treatment on alternate days until a cure is effected.

THE APIARY.

E. A. EARP, Apiary Instructor.

UNITING COLONIES.

THE presence of weak hives in the apiary must be avoided as far as possible. During the warm autumn days these colonies rarely escape the attention of robber-bees and are easily molested. When once they are attacked the beekeeper will find it extremely difficult to save them, and eventually they will get robbed out despite his efforts. It is by far the better plan to unite them with a stronger colony than to run the risk of unsettling the bees in the dormant season through the encouragement of wholesale robbing. A simple method of uniting colonies was explained in the February issue of the *Journal*.

COVERS.

With the approach of the rainy season it is advisable to make a complete examination of the covers in use. Altogether too little attention is paid to making the covers watertight, and neglect in this direction leads to winter losses. No amount of labour should be spared in saving the bees from exposure and dampness and by so doing warding off the large annual losses that occur through neglect. There is no excuse for the beekeeper neglecting to protect his bees, and he will find in the long-run that a small

expenditure on some suitable waterproof roofing-material will doubly repay him, and will be the means of saving colonies that would otherwise be lost. Bees must be kept dry. An examination made of colonies where proper protection is not provided will reveal the presence of large quantities of propolis. Usually this is collected to prevent the penetration of external moisture, and it is noticeable that it is gathered freely in the autumn months. Where adequate protection is provided the bees are saved the labour to a large extent of collecting the propolis, and by providing dry roofs the beekeeper is assisting them. In the case of roofs that are cracked do not attempt to tinker with them, but cover entirely with some waterproof material. In the long-run metal coverings are the cheapest and the best. Good zinc or galvanized iron makes ideal covering and will last for years. Quite a number of beekeepers are now using ruberoid or similar materials with very good results. Whilst not so durable as metal, they serve the purpose admirably, and with careful treatment will last for a number of seasons.

MARKETING THE CROP.

At the close of the season the beekeeper should give his undivided attention to marketing his crop. It usually happens that a good year causes something akin to a panic among a large proportion of the producers, and as a result they are too anxious to dispose of their crop at anything but remunerative prices. An instance has come under my notice this season where a beekeeper sold a ton of honey to a retail house at 4d. per pound. Now, it is quite evident that the producer did not for one moment count the cost of production. The advance in the price of working-equipment, packages, &c., has become a serious burden on the profits of the apiary, and at the present moment there is every indication that the cost of packages to the producer will be again greatly increased. Apart from the cost of equipment, very few beekeepers take into consideration the amount of labour and time requisite to produce a crop; and, if beekeeping is to be made to pay, these factors must not be lost sight of. Where bees are run as a side-line very rarely do we find the item of labour charged against the crop, and as a result it is sold at a low figure. There are far too many jobbers in the honey trade. Their operations act against the legitimate producer and tend to unbalance the market. Too often the beekeeper is led away by their talk of overproduction and lack of demand for his commodity, and he is anxious to dispose of his crop before his fellow-producers can dispose of theirs. A brighter, better, and more businesslike way of dealing would be for beekeepers in every case to meet together and fix prices. By organized effort the price of honey

can be reasonably raised and its value as an article of food placed before consumers. It is pleasing to note that the principle of co-operation is being steadily extended among honey-producers, and that the operations of the Honey-producers' Association, which was formed for the purpose of jointly handling the product of the individual, is creating a basis for eliminating the middleman, and leading to quicker and larger sales, with more uniform and better prices. The building-up of a payable local market depends largely on the disposal of the surplus crop, and this can only be accomplished by an organized scheme of export. The efforts of the industry to arrange such a scheme have been the means already of increasing the local market value of honey.

With respect to the local market, until such time as the producers are combined for the purpose of establishing bottling-depots in every centre the beekeeper must not relax his efforts in preparing his crop for market, more especially if increased consumption and higher values are the objective. In the absence of co-operative bottling-depots too many beekeepers make the mistake of forwarding their honey in bulk lots, to be afterwards retailed under a name which is not that of the producer, and usually not even that of his agent. It is far better for the beekeeper to attend to his own bottling than to allow his honey to be disposed of haphazard by any one into whose hands it may fall. While honey is in a liquid form it is little trouble to fill 1 lb. or 2 lb. packages, stamped with his own name and trade-mark, and in a year or two he will find that his product will need no advertisement. Quality and care tell in the long-run. Before next season opens the progressive man should have decided what brand and what size of packages will best suit his trade, and should as far as possible have made arrangements for thus disposing of his crop. Looking at our markets to-day, we find the crop is moved off as quickly as possible, and no general effort is made to supply honey at all seasons of the year. The honey-producers' methods in this respect are on a par with those of too many of the fruitgrowers — the same rush methods are followed whereas by organization both industries can be placed on a sound commercial footing and continuity of supply maintained.

The value of attractive packages should weigh with the producer, whether the honey is put up in bulk for the merchant or in small packages direct for the retail trade. In order to appeal to the consumer the packages containing honey must be made as attractive as possible, and every care observed in its preparation as an article of food. An inspection of lines sent forward to market will serve to demonstrate the advantage of careful preparation. Consignments forwarded in good clean cases, carefully graded, and contained in new tins readily command attention

whereas lines which have been packed in rusty tins and present a rather unattractive appearance generally are hard to dispose of, and too often merchants are compelled to sell at a reduced rate, although the quality of the honey is quite on a par with that packed in new packages. In such cases the producer is apt to blame the merchant for a reduction in price, but as a rule the fault lies with himself. The requirements of the Sale of Food and Drugs Act are such as to compel the beekeeper to label his packages, and to state thereon the contents and weight, also his name and address. The regulations are fast eliminating old-style methods in handling honey, and are helping to advertise it in a manner hitherto unthought-of by the beekeeper.

EXPORT POINTS.

The season for export is here, and producers will no doubt be busy preparing the product prior to sending it forward to the grading-store. Exporters who have failed in the past to secure the maximum number of points in any class should carefully handle their product and make a thorough examination of the honey at intervals so as to ensure its arrival at the grading-store in good order. To-day the British buyer is looking for the graded article, and it thus behoves the beekeepers to offer of the best of their product for export. The essentials of a good export honey are, firstly, that it must be well conditioned—*i.e.*, granulated, and free from the slightest trace of ferment; secondly, it must be entirely free of scum—*i.e.*, wax-particles and dirt; and, thirdly, it must have received strict attention in packing. These factors are the basic provisions of export, and are provided for under the regulations in force. The object of Government grading is to create a good name for the New Zealand product on the oversea market, and establish our reputation as producers of a high-grade article. To this end the exporter can assist by forwarding shipments of uniform grade and quality, and by thorough attention to detail in packing.

A great deal of time and labour could be saved if the producer would learn to tentatively grade his own product. This may be done at extracting-time, when each separate extracting can be marked, and the information conveyed to the grader. There are seasons in the Dominion when each successive extracting will vary, and each lot of cases should be marked accordingly. It may happen that the colour will vary, in which case, with a view to facilitate grading, a note despatched to the grader, intimating for instance, that there are so-many cases of light amber and so-many cases of medium amber in the consignment, would be the means of preventing a great wastage of time at the grading

store. Honey that is not granulated should not on any account be submitted for export. The regulations provide against liquid honey leaving the country, and honey that is semi-granulated will be held up at the expense of the producer.

In order to ensure safe transit, only good, strongly constructed tins should be used, and any showing signs of rust rejected. All tins must be carefully lacquered or oiled on the outside to prevent rusting, and this operation is best carried out when the tins come to hand from the tinsmith and prior to filling them with honey. Lacquer can be procured from the dealers at a reasonable cost, but, if desired, boiled linseed-oil may be substituted, and its action is just as effective as that of the lacquer in obviating rust. Press the lids on tightly, but on no account use solder to secure the caps, as each tin has to be opened at the time of grading. In the past large numbers of tins have reached the grading-stores minus their lids and this has been more noticeable where the caps have exceeded 3 in. in diameter. A uniform cap of 3 in. would ensure security and prevent to a large extent their becoming loose in transit. Under the regulations the graders have power to reject tins where the lids are ill-fitting. See that the cases are strongly constructed and neatly bound at each end with wire or metal strapping. Good cases are of paramount importance, and good well-seasoned timber should be used in their construction. False economy in this direction cannot be too strongly condemned. Brand the cases on one end only, and stamp the net weight of the contents of the tins on each case. In all cases where the weight of the contents does not coincide with the weight stamped on the package a grade certificate will be refused.

THE GARDEN.

W. H. TAYLOR, *Horticulturist.*

VEGETABLE-CULTURE.

Garden Economies.—The value of the soil does not depend upon its area, but on the amount it produces—in relation to the cost of production. It is more economical to grow a large quantity on a small space than a similar amount on a large space, although this theory cannot always be applied in practice. A garden is intended for cultivation of a more thorough character than is possible in a field, where crops are largely at the mercy of the weather. An abnormally wet season, or the opposite, may ruin a field crop. The comparatively small area of a garden renders it possible to success-

fully combat such adverse circumstances. Deep trenching makes the soil warmer in winter and cooler in summer than it would otherwise be. Rain sinks freely through trenched soil, and the water-table is lowered; the draining of the soil is aided and evaporation prevented. When water holds in the ground near the surface it is slowly dispelled by evaporation, which makes the soil very cold. Trenched soil, if properly under-drained, holds a right quantity of water in suspension, which does not prevent a proper aeration of the soil, a state that is most important.

A certain amount of humus is necessary to maintain fertility in any soil. Light soil is rendered more holding by humus, heavy soil is made more free. Heavy loamy soil deficient in humus becomes pasty when wet, harsh and hard when dry—hard to get into condition, and difficult to keep so. Soil that is well trenched and drained, and has a sufficiency of humus, may be likened to the satyr in the fable, who blew both hot and cold: it will grow the earliest crops because it is comparatively warm at that season; it will grow summer crops because its depth renders it comparatively cool and moisture-holding. Trenching soil, of course, means labour, but the latter is of a very remunerative character. Not only will trenched soil produce a maximum crop, but it is fit for any and every kind of crop, and at all seasons.

The waste parts of vegetables can usually be converted into humus, it may be by returning them at once to the soil, or by putting them in a heap to decay. When cabbages or similar vegetables are cut for use the waste leaves should not be left on the ground. Turnip-tops should be carried off. There is no better breeding-ground for slugs than is provided by decaying vegetable matter of this kind. When convenient, it is a good plan to have a trench open, and throw vegetable-refuse on the bottom, including cabbage-stumps. A convenient yet not too conspicuous place should be chosen to keep rubbish. There is always vegetable waste in the garden, and weeds also. Everything should be thrown on the heap, and now and again a sprinkle of lime thrown on it. Lime prevents the formation of fungus-spores, keeps the heap free of insect pests, and prevents the escape of ammonia. Turning over occasionally will sweeten the heap and assist decay. Such heaps afford a supply of humus and fertilizing-matter invaluable for use as a top-dressing. Any owner of a garden who consistently follows this practice will find that the resulting cleanliness of the garden will cause a great decrease in the number of slugs and other garden pests.

Economy in labour may often be effected when preparing soil for crops. Digging the soil is not always necessary or advisable. Digging may be necessary to loosen hard soil, to cover a dressing of manure, or to bury weeds. If none of these things is required it

may be better not to dig. During summer the surface soil becomes very dry, and, if dug over, the new surface becomes dry also, with the result that the whole top spit becomes dry instead of perhaps only a few inches from the surface; it is also loose, and so susceptible to still further drying. It would often be better to hoe the surface than to dig the plot. At the same time, a fertilizer could be hoed in. For broccoli and Brussels sprouts, both doing best in firm soil, this is decidedly the best preparation, and for crops generally it is sufficient even when not best.

Current Work.—Peas may be sown about the middle of May. Autumn-sown peas are not always a success in the coldest parts of the Dominion, and should not be sown in quantity in those districts, being, in fact, in the nature of a chance-crop. In the more northern districts sowing peas at this season is a matter of ordinary routine work. In these parts peas do not do well after midsummer, so the season for them should be lengthened by starting in autumn. Sow both a dwarf variety and a taller sort at the same time. Where slugs are troublesome the peas should be supported by sticks; the slugs would then do no damage. Birds will not eat peas that are supported by sticks—at least, I have never known them to do so. Broad beans may be sown if required early; otherwise they may wait till mid-June.

Winter rhubarb I regard as a most valuable plant in any garden; it does not displace the summer varieties, but fills the gap while these are out of use. It is somewhat of a puzzle to me why this class of rhubarb is usually so badly grown. I can only suppose that it is debilitated by being used unfairly. My experience is that with no special treatment it gives abundance of fairly stout sticks from 18 in. to over 2 ft. in length. It seems necessary to always leave some leaves to grow; never pull it bare, and rest it for a few months in summer by pulling nothing or only sparingly. The soil should be well trenched, and although it cannot be overmanured it will do with a moderate amount. Winter rhubarb can be established by sowing seed where the plants are to grow, and thinning the plants to the required distances, about 2 ft. in the rows, and 30 in. between the rows. This, however, would have to be done earlier in the season; at the present time it would be best to procure roots, seedling roots preferably to divided crowns. If this be done the first growths should be left on the plants to establish them; more would quickly follow. If the first sticks were pulled it would check the roots, and it might take some time for the plants to recover, while if the process were continued it would ruin them.

Summer rhubarb requires lifting every third year. The crowns should be chopped up with a sharp spade, and small pieces with one or two or three good crowns be planted back. Roots to be

lifted may be taken up now, but the dividing process should be left till planting-time, six or eight weeks hence.

Seakale is one of the choice vegetables that should be in every good garden, but it is rarely one sees good seakale in this country, where it should be of the very best. This lack of quality is mainly due to want of proper treatment of the crowns. All that can be done at this time of year is to make the best of the plants as they are. Clear away all the old leaves, and weed the ground; owing to the dense foliage the plants carry, there are seldom many weeds around the stools, a hoeing and raking-over being usually sufficient. The heads should be blanched in relays. Cover the stools with a bottomless box or a kerosene-tin with top and bottom cut out, laying a piece of board on top so as to be able to get at the heads when ready. Surround the boxes or tins with fermenting manure. A fortnight is sufficient time to get the crop ready for the table, so forcing can be timed for special dates. In spring the heads start naturally, and at that time it is sufficient to cover the crevices that admit light by throwing soil over them; there must be perfect darkness. It will be seen that seakale is useful even if there is no manure available to force it, but, of course, it is less valuable. Always give a good liming to kill slugs before covering the heads.

Turnips should now be ready for thinning. If two varieties were sown, one white and one yellow fleshed, the latter should be thinned sufficiently to allow for proper development without further thinning, as these roots (or some of them) should be kept for late use. They hold on longer than the white-fleshed varieties which may largely be thinned by judicious drawing as they are wanted for use.

Asparagus: Cut down the tops and burn them, or if trenching is being done place them in the bottom trench. Strip the soil from the crowns so as to lay them bare, and top-dress liberally with manure. Do not return the soil at the present time.

SMALL FRUITS.

Strawberries: Owing to the prevalence of leaf-spot it is as well to destroy the old leaves, which may be cut off with a scythe and burned on the bed. If the leaves do not burn freely a little dry straw may be spread among them. The leaves should be left scattered; the fire will pass lightly through and do no injury to the crowns.

Loganberries: Remove all the old fruiting-wood, providing that sufficient new rods have been preserved to take its place. If there are plenty of new rods the old should go, as the new are the best for fruiting. Only the strong new rods should be kept, weak rods being cut out.

Cape gooseberries: Sow the seed now. Autumn-raised plants are far preferable to those raised in spring; they make stronger plants, and fruit well the first season. The seedlings should be pricked out in boxes, and be kept under shelter till spring frosts are passed.

THE FLOWER-GARDEN.

The period during which roses may be successfully transplanted extends from mid-April to the end of September. But it is not wise to take the bushes up after growth has commenced, which will be long before the latter time mentioned. If, however, the plants have been lifted earlier, and heeled in, the final planting can be left as late as stated. It is best to get them into their proper position in autumn, because that gives them time to become re-established before pruning-time, which is June, and they are then in practically the same state as if they had not been moved, with the benefits that in certain cases attend transplanting. After a few years bushes frequently become unsatisfactory. In some cases they refuse to flower, or flower only to a very minor extent; or they produce poor flowers, due in part to frequent cutting-back, making the growth twiggy. Also it may be that the soil requires breaking up. In such cases transplanting, or at least the first lifting, should be done as early as possible. A very drastic pruning will be necessary. Two-thirds of the bush should be cut away if it is a large one, and this is easiest done before digging it out. No plan of cutting is necessary; simply cut away just as may be convenient; the thickest branches will break quite freely. After a bush has been lifted the roots also should be cut back. With these, as with the tops, cut back without fear, however thick they may be; they will soon throw out new roots. In respect of top-pruning, the bush must not have its final treatment. None of the side growths on the parts left should be cut back; these are required to start new roots, and should be properly pruned in June. If the ground in which the bushes are to be planted is not ready, heel them in in good soil. They can be left heeled without injury till July, but if so late the final pruning should also be left and done when they are planted. This latter is the right treatment for any that may be heeled in and not planted until late, even if it is September. When roses are to be purchased it is far best to procure them early, and heel them in if the ground is not ready for them.

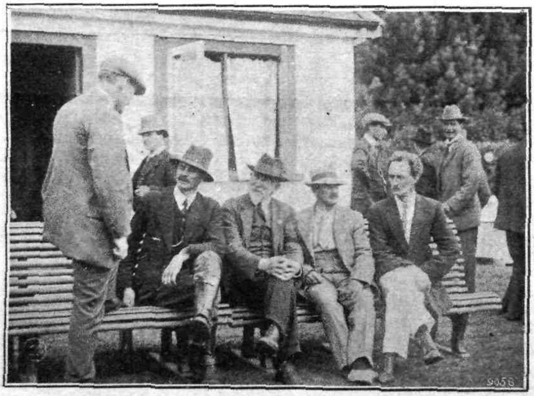
Lilies of all kinds that are to be transplanted should have that attention as soon as the tops are dead; they do not remain dormant long unless taken from the ground. The bulbs should be planted back at once. Plant deeply; very large bulbs of the auratum type may be planted in holes 18 in. deep, which points

to the necessity for deeply trenched ground. Lily-bulbs have a habit of working up to the surface; they also, as regards some kinds, increase rapidly and become crowded. Either of these causes may render transplanting necessary, otherwise they should not be disturbed, as they seldom give their best the first year after transplanting.

Primroses and polyanthus should now be transplanted where they are required. Violets should be left till spring, after flowering; if they are very much crowded, thin the plants freely.

Shrubs and trees of all kinds can now be transplanted. It is important when transplanting such subjects that the soil be trodden very firmly about the roots. If a ball of earth has been lifted with the shrub it is usually very hard; the added soil must be made quite as hard, or water will never enter the old ball, and the shrub will die.

Lawns: An error crept into last month's notes on this subject, where it was stated that lawn-grass should be sown at the rate of 1 lb. to 6 square yards. The quantity should have been 2 oz.



AT THE FIELD-DAY GATHERING—RUAKURA APIARY.

From left—Standing (in foreground): Mr. J. A. Young, M.P. Sitting: Mr. A. W. Green, Manager, Ruakura Farm; Mr. T. W. Kirk, Director, Horticulture Division; Mr. G. V. Westbrooke, Apiary Instructor; Mr. A. B. Trythall, Apiarist in charge.

ANSWERS TO CORRESPONDENTS.

In every instance a question to which an answer is desired in the *Journal* must be accompanied by the full name and the postal address of the inquirer, not necessarily for publication, but as a guarantee of good faith. The question should be written on one side of the paper only.

WARTS ON COW'S TEATS.

R. HUNTER, New Lynn:—

What do you advise as a cure for warts on a cow's teats? I have a cow which has a number of such warts; they are long and thin, and dry at the tips.

The Live-stock Division:—

The best treatment for warts on cows' teats is to snip them off with a pair of clean, sharp scissors when the animal is dry, touching the wounds with a stick of nitrate of silver (lunar caustic). It is a good plan to look over the heifers and cows some time before they come in, and carry out the treatment if they have any warts. One cannot do much when the animals are in profit, and the warts are an annoyance in milking and often get the animal into the habit of kicking. The following might, however, be tried: Get your chemist to make up 1 oz. of salicylic acid 2 parts, zinc chloride 1 part, collodion 15 parts. Apply a little to the warts with a camel-hair brush after milking. See that the teat is dry.

PEANUTS.

MISS M. SMITH, Kai Iwi:—

Please tell me how and where peanuts are grown. Would they grow and bear in ordinary garden soil, and when should the nut be planted? Are peanuts grown commercially in New Zealand? Why are they always so clean in appearance?

The Horticulture Division:—

The peanut, or ground-nut, is an annual plant, a native of Cochin China. The botanic name of the plant is *Arachis hypogaea*. Attempts hitherto made to cultivate the plant in New Zealand have not been successful. The plant appears to require a hot and somewhat dry climate, and soil of a sandy-loam nature. The nuts are grown commercially in China and California. The nuts are planted in late spring or early summer, the time being regulated by local conditions, occurrence of frost, &c. Early in November—the time for planting marrows, &c.—would be right for New Zealand. The reason why the nuts are clean is that they are left on the vine to dry for a few days in the sun, and the soil in which they are grown being light and sandy, it all falls off.

WHITEWASH FOR FOWLHOUSES.

"INQUIRER," Mosgiel:—

Will you kindly supply me with a formula for whitewash for fowlhouses suitable for use with a spray-pump. I find that lime blocks the nozzle, even when the wash has been strained.

The Live-stock Division:—

No formula of whitewash for fowlhouses which does not include lime can be recommended. The blocking of the nozzle of your pump is probably due to the mixture not being properly strained. Any limewash mixture should be strained at least twice through a piece of scrim. While there are many different mixtures

of whitewash used, the best and simplest, in our experience, is prepared as follows: Thoroughly dissolve some bluestone in boiling water—say, a teacup to a bucket of water—and mix the lime with this while hot. The bluestone will have the effect of making the mixture stick, and if well strained it will easily pass through an ordinary spray-pump. If the object of your spraying is to keep insect vermin in check, we would strongly advise you to give the houses a good coating with tar. When this is thoroughly dry it may be followed by a good spraying of the lime-wash recommended.

GRAZING AND SOIL-CONSTITUENTS.

"FARMER," Tirau:—

Kindly inform me which takes the most out of land—the grazing of breeding and growing stock, or the grazing of fully grown stock and fattening same. If any difference, please state the reason.

The Fields Division:—

Mature fattening-animals are less hard on the soil than breeding-stock and young growing animals, the reason being that the former have produced all their bone and do not require phosphorus and lime to any extent to make such; whereas young stock and pregnant and milking stock require plenty of phosphorus and lime for bone and milk formation. The manure from mature fattening-animals is thus richer in the mineral constituents mentioned, and hence returns more of these to the soil than does the manure of young stock and pregnant and milking animals.

BLIGHT ON PINE-TREES.

H. P., Sherenden:—

I have some *Pinus insignis* trees which are troubled with a blight resembling the mealy blight on apple-trees. It is dotted all over the stem and branches. The affected trees are about three years old, and they do not grow like the others. Information on the subject would be appreciated.

The Horticulture Division:—

The insect attacking your pine-trees is known as the "pine-kermes," and is allied to the scale insects. Young trees usually throw off the attack, but occasionally die. Young trees may be treated with a contact spray. Red-oil emulsion, 1 in 20; or kerosene emulsion, 1 in 12; or a proprietary specific, such as Vistolene or X.L. All fluid—are all suitable for the purpose.

CROPS FOR PIGS.

"SUBSCRIBER," Ongaonga:—

Will you kindly tell me the best time to plant beans for pig-feeding, or anything more suitable?

The Fields Division:—

Beans could be planted now for pig-feed if your locality does not have much frost. If frost is prevalent to any extent, however, you had better sow them in September. Artichokes constitute good feed for pigs, the latter doing the harvesting themselves, while the plants also provide good shade. Peas also provide good pig-feed.

COVERING GRASS-SEED.

"*NEW CHUM*," Kaipara:—

Kindly let me know the best way to cover grass-seed in hilly country—poor clay gum land. Would light harrows cover too deep, or rolling alone be better? The greater part of the land can be rolled.

The Fields Division:—

If rolling can be carried out, the roller with brush harrow attached behind should cover the grass sufficiently. Tine harrows would be inclined to bury the fine seed too deeply.

FORMS OF LIME.

F. R. K., Kaukapakapa :—

Please inform me whether the so-called hydraulic lime is suitable for agricultural use. What is the difference in chemical constituents between it and "agricultural lime"?

The Fields Division :—

Hydraulic lime is, chemically, hydrate of lime. It is produced by treating burnt lime with a definite quantity of water. Like burnt lime, it is caustic (burning). Seventy-four pounds of hydrate of lime is equal to 56 lb. of freshly burnt lime or 100 lb. of ground limestone. All three forms are useful in agriculture, and as such are agricultural limes. Where you use 1 ton of burnt lime you will require to use a little over 1¼ tons of hydrate of lime.

CRICKETS AND FRUIT-TREES.

H. R. RADFORD, Waimauku :—

Kindly inform me whether there is a cure for crickets attacking fruit-trees. In some cases the trees are eaten right round. Is there any way of saving the trees?

The Horticulture Division :—

Are you sure the injury has not been caused by hares or rabbits? You might paint the trunks with a mixture of cow-dung and sand, or, if it is really crickets that are doing the damage, cow-dung and clay will answer as well. Crickets can be poisoned by arsenic mixed with boiled potato, or with grated raw potato or carrot.

MUSTARD AND MILK-TAINTING.

L. A. M., Dannevirke :—

Can white mustard mixed with black barley and green oats be fed to milking-cows without tainting the milk and butter, as is the case with turnips?

The Fields Division :—

A certain degree of tainting of milk will result from feeding cows on mustard in mixed forage.

TREATMENT OF FOOT-ROT IN SHEEP.

M. L. A., Runciman.

I should be much obliged if you would publish in the *Journal* a good recipe for a foot-rot paste or solution for sheep, or any other good cheap method of treatment.

The Live-stock Division :—

A good solution is an arsenic solution. The best way to apply is to put it a foot-bath and drive the sheep through. A stout wooden trough 12 ft. long l 18 in. wide by 6 in. high at the sides and ends should be made. Battens shou be placed across the bottom to prevent the sheep slipping. Hurdles are plac securely on each side and on the entrance and exit, forming a race, wing-hurdl being placed at the entrance. The exit should be into some bare yard or lai capable of holding the sheep half an hour or so until the feet dry. If they a put directly on to grass land the solution drips on to the grass, and any anim eating it would probably be poisoned. The solution is made by boiling 2 lb. white arsenic with 2 lb. of carbonate of potash (pearlash) in a gallon of water ov a slow fire until the arsenic is dissolved. Arsenic by itself is only feebly solut in water, and such solution would be no good. To the solution specified ac 5 gallons of water. Sufficient solution may then be put into the bath to cov the feet, and the sheep walked slowly through, adding more solution from tir to time to keep up the level. The operation is better done in dry weather. the sheep are fairly sound, putting them through every couple of months shou be sufficient as a preventive. Of course, if they actually have foot-rot they cou be put through much oftener. Care should specially be taken to keep the troug

utensils, &c., when not in use, in a safe place, as arsenic is very poisonous. You will find that wool placed in the bottom of the bath and saturated with the arsenic solution will prevent splashing. A more effective and less dangerous substitute would be sulphate of copper (bluestone). A convenient preparation can be made by carefully mixing over a slow fire 1 part of powdered bluestone with 1 of lard and 2 of tar. This is applied to the affected feet after the removal of loose and diseased horn. This latter remedy is suitable for specially bad cases.

SHEEP "BLOWN" ON SORREL.

"SUBSCRIBER," Bennett's :—

A number of my ewes broke into a ploughed paddock with young sorrel growing there, and when I went to put them out I found one just about dead and one bad. They breathed heavily, frothed at the mouth, and seemed more or less blown out, though they did not show signs of much pain. Kindly state whether the beasts were simply blown, or whether the trouble was caused by the acid in the sorrel. What is the correct treatment?

The Live-stock Division :—

Sorrel contains a little oxalic acid, but it is not poisonous to stock. The ewe *was probably "blown," the treatment for which consists in giving a little linseed-*oil, a small teaspoonful of sal-volatile, and one teaspoonful of powdered charcoal. The animal can be gently moved, and the swelling rubbed. Sometimes a stick is placed in the mouth to assist the escape of gases. In advanced cases stabbing can be resorted to. The puncture should be made at an equal distance between the hip, last rib, and the end of the false ribs. The wound must be covered with a pitch-plaster the next day. The above treatment would probably only be considered worth while in the case of stud or other valuable sheep. Driving the affected animals gently round in the paddock would be a more practical remedy with ordinary sheep. Blowing of sheep is, in any case, very rarely met with.

POULTRY HINTS.

A most common cause of hens flying out of the run is their *not having a sufficient supply of food.*

A good layer must necessarily be a big eater, and must therefore have a large crop-development.

Absolute cleanliness is the great safeguard in keeping insect pests at bay.

Overfeeding of rich foods and want of exercise is the chief cause of leg-weakness in growing stock, while it is sometimes due to constitutional weakness.

Poultry-sick ground is not conducive to the maintenance of fowls in good health, which is imperative if they are to lay to the best advantage.

Increasing the number of stock kept does not necessarily mean increased profits. Strict attention to details is the great determining factor, the essentials of which are the right class of stock, good housing, cleanliness, and a sound system of feeding.

—F. C. Brown, Chief Poultry Instructor.

THE POTATO-MOTH.

THE following information regarding the potato-moth and its control was furnished by the Fields Division to a correspondent in North Otago who had forwarded a grub-infested potato together with various questions concerning the pest:—

The grubs in the specimen of potato submitted are the larvæ of the potato-moth, perhaps the worst enemy of the potato-grower. Potato-moths are usually more plentiful after a mild winter. There are two broods of moths. The first, the winter brood, may destroy the young plants and thereby ruin the crop. The moths of the second brood deposit their eggs on the potatoes themselves when the tubers are stored or are in the field. Occasionally, especially if potatoes are grown in stiff soil, the moths will crawl down the cracks in the ground and deposit their eggs on the tubers. The eggs are usually from twenty to thirty in number, and hatch in from six to ten days. In sandy soils tubers are rarely so attacked. The young grubs when hatched usually feed upon the eyes of the potatoes; they then tunnel towards the centre of the tubers, causing them to become brownish-black, and inducing decay. Sometimes when the potato-plants are fully grown the female moth deposits her eggs on the leaves. The young grubs feed on these, and afterwards gnaw their way down the main stalks, reaching the tubers below.

Fortunately for growers, the chrysalids (stage between caterpillar and moth) of the potato-moth are attacked by parasites, bacterial diseases, and climatic influences, which destroy great numbers. The caterpillar of the potato-moth usually pupates (winters-over) under the skin of the potato, and is surrounded or protected by dirt, excrement, &c. It may also winter-over in the shaws lying about.

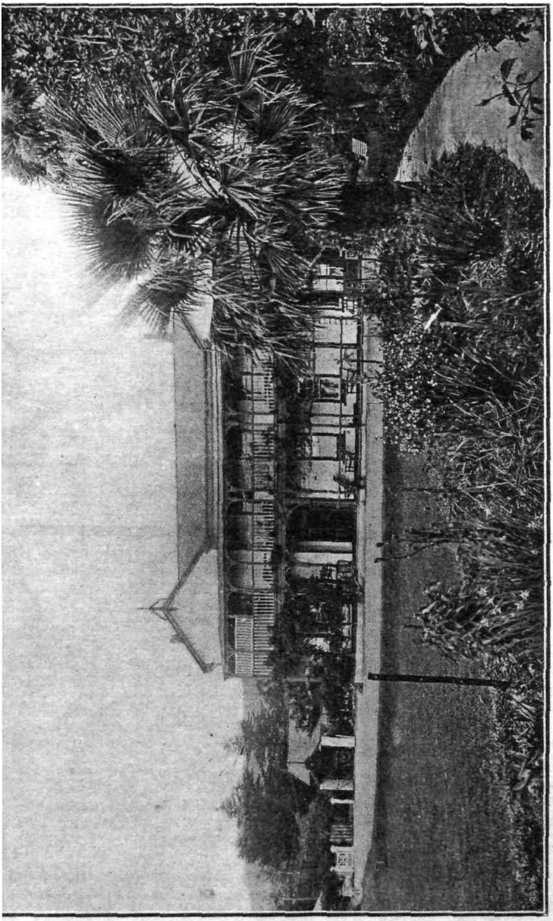
Preventive and remedial measures are as follows: Dead potato-plants, discarded and small potatoes, and rubbish should be gathered and burnt. Old sacks and cases in which there have been infested potatoes should be dipped into boiling water. By this means any grubs or chrysalids secreted in them will be destroyed. Seed infested with the grubs should never be planted, nor should ground where moth-affected potatoes were grown the previous year be used again for potatoes. Plant the seed deeply and keep it well covered. The ground should be pressed firmly down, and it is advisable to till it a second time. Never leave potatoes exposed in the field. When they are dug up they should be at once bagged and removed to storage, where they must be placed in bins, pits, or any other places where moths cannot get at them to lay their eggs in the eyes of the tubers. It is a common practice with many growers to simply heap the potatoes up in a storeroom without any covering, and to leave the doors wide open. No wonder considerable losses occur.

Trapping by means of lamps is of use in destroying the moths, which fly about at night. Procure an ordinary tin basin, and in this place a brick and enough kerosene to reach half-way up the brick, and on the brick a lighted lamp. The moths are attracted to the light, and, flying against the lamp, fall into the kerosene, which kills them. The basin could be placed on an ordinary box, such as a kerosene-case. Several of these lamps could be placed in a field of potatoes at night-time.

When the moths commence to make their appearance it is advisable to spray the crop with some arsenical spray, such as arsenate of lead. This will destroy the young grubs as soon as they commence to feed. A good arsenical spray is prepared as follows: Boil 1 lb. white arsenic and 2 lb. carbonate of soda (crystals) in ½ gallon of water for twenty minutes. Separately dissolve 7 lb. arsenate of lead in 1 gallon warm water. When both mixtures are cold mix them together. Bottle into twelve 1-pint bottles, and use one bottle to 30 gallons of water. Mix the chemicals in wooden buckets. Reliable brands of ready-made mixtures of arsenate of lead are on the market for those who prefer purchasing these.

One careless grower of potatoes in a district who does not take precautions to protect his tubers from the ravages of this pest can breed enough moths to ruin his neighbours' crops.

Potatoes affected slightly or otherwise should not on any account be kept for seed. They should be boiled for pig-feed, and the bags, &c., scalded with boiling water. Clean potatoes can be kept free from the moth by careful sealed storage, as described. When they are selected for planting the seed should be treated with a weak solution of formalin. Every care should be taken to destroy all affected potatoes, large and small, and shaws.



A HAWKE'S BAY STATION HOMESTEAD.

THE WORLD'S WHEAT-SUPPLY.

FUTURE COURSE OF PRICES.

IN a statement dated the 16th January, 1917, analysing the international wheat position, Sir J. Wilson, K.C.S.I., delegate of Great Britain (and of New Zealand) to the International Institute of Agriculture at Rome, discusses the question of the future course of prices as follows :—

The future course of wheat prices must to a large extent depend upon the course of the war, and especially upon the prospects of the opening of the Dardanelles, and upon the results of the German submarine campaign. It must also depend to a large extent on the action of the Governments who now control such a large proportion of the buying and selling of wheat for import and export. I have estimated that all the countries in the world whose ports are open are likely to require for net import in the year ending July, 1917, altogether 160,000,000 quintals,* of which 103,000,000 quintals are now bought by one body acting for the Governments of Great Britain, France, and Italy. On the other hand, I have estimated that, including the exportable surpluses brought over from last year and the whole of the probable exportable surpluses of the present or coming harvest in the Argentine, Australia, and India, the exporting countries whose ports are open will be able to spare for export within that year 163,000,000 quintals, provided they are persuaded and enabled to export it all before the 1st August. Of that quantity no less than 100,000,000 quintals will have to be brought from such distant countries as the Argentine, India, and Australia, and, of this, 85,000,000 quintals in India and Australia is subject to the control of the Governments of those countries.

In such circumstances it is impossible to make any probable forecast of what the Governments, in whose hands now are largely centred the arrangements for import and export, are likely to do. Apparently the Australian Government, which controls more than one-fourth of the possible exports, has recently reduced its f.o.b. price from 45s. to 38s. per quarter (4s. 9d. per bushel). The cost of transport from Australia to Europe and the price at which the Australian wheat will be sold in Europe depend upon the decisions of the British Royal Commission on Wheat-supplies, which will have a great effect in determining the price of wheat, not only in the importing countries, but also in the other exporting countries whose ports are open to trade.

If the war continues, there is likely to be great difficulty in transporting enough wheat to Europe to meet its demand and maintain its reserves; and, in any case, the countries whose ports are open will on the 1st August have, taken together, somewhat less wheat in stock than usual, while so far the prospects of the next harvests are not on the whole favourable. Prices, therefore, may rise still higher. The one thing that seems certain is that prices in North America will continue to fluctuate violently, according to the changing views of speculators as to the prospects of peace.

PROBABLE COURSE OF PRICES AFTER THE WAR.

It is perhaps time to make a forecast as to what is likely to happen to the world's price of wheat after the war. Should peace be declared about the 1st August next, and the surplus of Russia, which I have estimated as 47,000,000 quintals on the 1st January last, and what remains of the surplus of Rumania, which I have estimated as 5,000,000 quintals, become available for export, then, even allowing for an entire exhaustion of the wheat-stock of Germany, Austria, Hungary, Bulgaria, and Turkey, the world is likely to find itself in possession of a stock of wheat probably larger than its usual carry-over on that date in a normal year, though no doubt it will be abnormally distributed. If it be supposed that the coming wheat harvest in the Northern Hemisphere will, on the whole, be approximately equal to the average of the five years before the war, the price of wheat in the world's market will be chiefly dependent on the extent and urgency of the demand from the importing countries. Some of the chief importers—Great

* A quintal of wheat is equal to 3·67 bushels, or rather less than half a quarter.

Britain, Italy, and France—are likely to have built up larger reserves than usual, and, with their own harvests ripening, are not likely to be very urgent in their demand. The enemy countries also will have their own harvests to carry on with, and, although they will require large supplies of wheat to make up their deficiencies and restore their exhausted reserves, will probably be inclined to wait a few months in hopes of prices falling, more especially as their consumption is likely to be considerably less for some time than it was before the war, as their population has been reduced, and so many of them have become accustomed to consume less wheat than before, and will have good reason to continue the economy they have learned to practise. They will have especial reason to buy as little wheat from abroad as possible, owing to the depreciation of their paper currency and the lowness of the present maximum price of wheat to which they have become accustomed, and which measured in gold is much below the prices prevalent in the world outside them. This will be seen from the following statement :—

PRICES OF WHEAT MEASURED IN GOLD.

Country.	Average Price before the War after deducting Import Duty. Shillings per Quarter of 480 lb.	Present Approximate Price. Shillings per Quarter of 480 lb.
Importing Countries.		
Great Britain and Ireland	35	80
France	32	54
Italy	35	50
Germany	32	42
Austria	..	36
Exporting Countries.		
United States (Chicago)	30	61
Canada (Winnipeg)	30	62
India (Bombay or Karachi) ..	31	40
Argentina (Buenos Ayres)	31	59
Australia (Melbourne)	31	38
Russia (Odessa)	33	32

From this comparison it will be seen that while measured in gold the present price of wheat in Great Britain, the United States, Canada, and the Argentine, where the Governments have not yet exercised full control over the price, is double or more than double its normal price before the war ; in France, Italy, India, and Australia, where the Governments have practically fixed the price, the rise measured in gold is not nearly so great ; and in Germany and Austria, where the price has been fixed in inconvertible and depreciated paper currency, the present price measured in gold is very much below the current price in the world outside. The price in Russia measured in gold is much the same as it was before the war, and very much below the current price outside. As soon as peace is declared and all ports are thrown open to trade, then, as Russia is an exporting country with a large surplus to dispose of, one may expect a rapid rise in the price in Russia, whether measured in gold or in paper roubles, and a rush to export, so far as means of transport can be made available. In France and Italy, as the price of wheat has, by the action of the Government, been kept much below the real world's price, one may expect a temporary rise in price, whether measured in gold or paper, which will lead those countries to import as little wheat as possible until their reserves of old wheat and their new crop threaten to become exhausted. In Germany and Austria, both importing countries, with supplies of wheat nearly exhausted, although their requirements for wheat from abroad may be more urgent, the existing price measured in gold has been kept so much below that prevalent in the world outside that if they are to obtain wheat from abroad they must pay for it a price, whether measured in gold or in depreciated paper, very much above the price at present in force in those countries. They may therefore be expected to endeavour to get along with as little wheat from abroad as possible until their own new harvests are approaching exhaustion. Altogether, then, when peace is declared, the demand of the importing countries is not likely to be either so urgent or so large as might be thought probable on the supposition that they would at

once demand as much as was necessary to build up their usual stocks and restore their normal rate of consumption. And as the supply of wheat in the world as a whole is likely to be somewhat larger than the usual carry-over on the 1st August, it seems probable, on a consideration of the comparison between demand and supply taken by itself, that there will be, soon after the conclusion of peace, a rapid fall in the world's price, especially in Great Britain, and a rapid rise in Germany and Austria, whether measured in gold or in paper. Prices may not vary very much in France and Italy, where the present price measured in gold, while well below the world's price, is not so far below it as it is in Germany and Austria.

Turning to the exporting countries, there will probably be a rapid rise of price in Russia, whether measured in gold or paper roubles, for reasons already explained; a rapid fall in North America and the Argentine; and possibly a slight fall in India and Australia, where the action of the Governments has prevented the rise of price from being nearly so great as in the other exporting countries.

But the course of prices will greatly depend on the question of transport. The present rates of ocean freight compare as follows with those current before the war :—

FREIGHT ON WHEAT OR MAIZE.

Ports.	Average Rate before the War, per Quarter of 480 lb.	Latest quoted Rate, per Quarter of 480 lb.
	s. d.	s. d.
New York to Liverpool ..	1 7	20 0
Karachi to Liverpool ..	3 7	29 0
Buenos Ayres to Liverpool ..	2 9	27 4
Australia to United Kingdom (sailer)	5 7	25 9

The rates of freight after peace is declared will depend mainly on the demand and supply of ocean transport.

According to Lloyd's Register, the steamer merchant tonnage of the world was as follows :—

1st July,	Number of Steamers over 100 Tons Gross.	Gross Tonnage. Millions of Tons.
1910 ..	21,445	35·1
1914 ..	23,865	43·1
1916 ..	23,571	43·0
The figures for Germany are,—		
1914 ..	2,090	5·1
1916 ..	1,708	3·9
and for the United States,—		
1914 ..	1,178	2·1
1916 ..	1,343	2·9
and for Great Britain,—		
1914 ..	10,123	20·5
1916 ..	10,030	20·5

The United States are building fast, and expect to launch 294 new steamers, of 904,000 tons, during the current fiscal year, besides a large number of wooden vessels of over 500 tons gross; and probably other countries are also building new ships as fast as they can. Even if Germany's submarine campaign proves more successful than it has yet been, it is probable that on the 1st August next the total tonnage of the world's merchant shipping will not be much less than it was on the outbreak of war, and certainly larger than it was in 1910.

Germany's interned and laid-up shipping, with a gross tonnage of approximately 4,000,000 tons, or nearly a tenth of the world's gross tonnage, will immediately become available, and make an important addition to the supply of shipping for general purposes of trade. And, although a large proportion of the shipping at present requisitioned will be required for some time to repatriate troops and munitions, it is probable that a considerable proportion will be at once set free for ordinary commerce, as, at all events, the demand for military purposes will become much less urgent. It seems probable, then, that soon after the declaration of peace the supply of merchant shipping in the world as a whole available for purposes of trade will be as large as it was on the average of the five years before the war.

As regards the demand for shipping, apart from the temporary military requirements, I have given reason to believe that the demand for the ocean transport of wheat and other forms of food will immediately be relaxed, and will for some time be, on the whole, less than it normally was before the war. The demand for raw material is not likely for some time to be so great as it then was, for it will be only after considerable delay that the industrial organization of the principal manufacturing countries will be restored to its old standard of efficiency. On the whole, then, it seems probable that for some considerable time after the declaration of peace the world's demand for shipping will be less than it was on the average of the five years before the war, while the world's supply of shipping will be as large as it was on the average of those five years. The rates of ocean freight, then, may be expected soon to fall to a level not much above that normally prevalent before the war. War-risk insurance will also cease, and this in itself will reduce the price of imported wheat by a shilling or two per quarter. The fall in ocean freight rates, taken by itself, will tend to lower prices in importing countries, and to raise them in exporting countries.

There is another factor to be taken into account. International prices are gold prices, and the price of commodities measured in gold depends on the relation between the quantity of commodities to be exchanged and the demand and supply of gold available for the purposes of currency. The gold-mines have continued to add to the world's stock of gold, which will be larger at the end of the war than it was at the beginning. Owing to the war, enormous quantities of gold have been withdrawn from circulation and hoarded by treasuries, banks, and private individuals. Soon after peace is declared the treasuries and banks are likely to reduce their stock of gold, which is expensive to maintain, especially at the high rate of interest which will prevail for some years after the war, and numerous private persons are also likely soon to recover confidence and to produce gold from their private hoards, at present larger than usual, especially in India. On the whole, the resources of the population of the world have been much reduced by the war, and the demand for gold for purposes other than those of currency is likely to be less than before the war. Further, the demand for currency purposes also is likely to be less, as so many people have become accustomed to use paper money or silver coin where they formerly used gold, and it will be long before the enormous quantities of paper money now in circulation can be reduced to anything like its previous dimensions. On the whole, then, the supply of gold available for purposes of currency (other than reserves) is likely to be larger than before the war, and the demand for it less, so that in relation to all other commodities taken together gold will be cheaper than it was before the war, or, in other words, the gold prices of all commodities, including labour, will tend to remain higher than they were before the war. This tendency, however, is likely to have much less effect in keeping up the price of wheat than the other tendencies noted—viz., the opening of the Russian ports, the slackening of the present urgent demand, and the increase in the available supply of shipping—are likely to have in bringing it down.

Putting all these considerations together, it seems probable that soon after the declaration of peace there will be a very rapid fall in the rates of ocean freight, a very rapid fall in the price of wheat in the United Kingdom, a very rapid rise in Germany and Austria, and perhaps a temporary rise in France and Italy, unless the Governments of these countries take steps to counteract it at the cost of the general taxpayer. There will be a rapid rise in price in Russia, a rapid fall in price in North America and the Argentine, and a less rapid fall in India and Australia. To put the estimate in concrete form, it seems possible that if peace is declared by the 1st August and the coming world's wheat harvest turns out to be not much below the average of the five years before the war, No. 2 Northern Manitoba wheat* may be selling at Liverpool before the end of next December at less that 45s. a quarter, and at Winnipeg at less than 40s. a quarter (120 cents per bushel), and that English wheat may be selling at not much above 40s. a quarter.

* This wheat is quoted as a standard.

The British Food Controller has appointed a committee to make such arrangements as may be necessary and expedient for the increase of supplies of fertilizers in the United Kingdom, and for controlling their output and distribution.

PURCHASE OF HIDES BY THE GOVERNMENT.

PARTICULARS of the purchase of hides for war purposes by the Government are contained in the following notification by the Hon. W. D. S. MacDonald, Minister of Agriculture, gazetted on the 14th March, 1917, in conjunction with an Order in Council prohibiting the export of hides and calf-skins to any destination.

1. The New Zealand Government (hereinafter referred to as "the Government") is prepared to purchase for and on behalf of His Majesty's Government of the United Kingdom all hides, including calf-skins, suitable for the requirements of that Government and not required for use within New Zealand, on the terms and conditions and in accordance with the scheme hereinafter set forth.

2. The persons named in the First Schedule hereto, and hereinafter referred to as "Government brokers," will act as the agents both of the Government and of the sellers in the purchase of hides by the Government in accordance with the following provisions.

3. *For the purposes of this scheme the licensee of a meat-export slaughter*house, or the manager of the store in which hides from the public abattoirs named in clause 4 are stored, shall in the matter of receiving, trimming, salting, classifying for valuation, storing, invoicing, bagging, branding, and delivering f.o.b. ocean steamer, *accept the same responsibilities as are required of a Government broker.*

4. Hides for sale to the Government must be delivered to a Government broker at the broker's receiving-depot established at any place specified in the First Schedule hereto, except that, in the case of hides stored at a meat-export slaughterhouse or at the public abattoirs of Christchurch, Dunedin, and Invercargill, and derived from cattle slaughtered at any such slaughterhouse or abattoir, the store in which they are contained will be held to be a receiving-depot for the purposes of this scheme.

5. Hides should be treated in accordance with the best freezing-works standard, and must be properly trimmed, and as free as possible from salt and fat, *and must have been at least fourteen days in salt when submitted for purchase.* The tare allowance will be as follows: On all hides up to the best freezing-works standard which have been properly washed before salting, 4 per cent.; on all other hides the tare to be as under:—

Per hide—	6 lb. to 16 lb.	1 lb.
	17 lb. to 32 lb.	2 lb.
	33 lb. to 69 lb.	4 lb.
	70 lb. and over	6 lb.

6. Hides so delivered will require to be classified in accordance with the Third Schedule for examination by a valuer appointed and paid by the Government and hereinafter called "the Government valuer."

7. Such hides, after examination and classification, shall be valued by the Government valuer, in accordance with the scale of values set out in the Second Schedule.

8. Any hides so delivered may be rejected by the Government valuer as not being of good marketable quality or in good marketable condition.

9. *On any hides being valued and approved by the Government valuer, the* Government broker, if duly authorized in that behalf by the seller, will purchase the same on behalf of the Government at the price at which they have been so valued. Such purchase will be effected by posting or delivering to the Controller of the Department of Imperial Government Supplies, at Wellington, an invoice for the hides, together with the Government valuer's certificate of classification and valuation on a form to be provided. All purchases so made will be subject to the condition that the seller will place the hides f.o.b. ocean steamer. If documents are in order the New Zealand Government, on behalf of the Imperial Government, will pay the amount of the purchase-money within fourteen days after the date on which the contract of purchase has been effected as aforesaid, and will also pay any storage after the expiration of twenty-eight days after the said date, the charges for storage to be at the rate of twopence per sack per week.

10. The property in all hides so purchased shall pass to the Crown so soon as the contract of purchase has been so effected, and the Government broker or

the licensee of the meat-export slaughterhouse, or the manager of the store, as the case may be, will thereafter hold them on behalf of the Government. All charges, except storage as aforesaid and insurance from the date on which the contract of purchase has been effected, shall be paid by the seller.

11. Payment for all hides so purchased will be made by the Controller of the Department of Imperial Government Supplies in accordance with the scale of values shown in the Second Schedule hereto.

12. The Government broker to whom any hides are so delivered for sale to the Government will act as the agent and on behalf of the seller in doing or causing to be done all things required in respect of the receipt, trimming, salting, and preparation for classification and valuation of such hides and the storage thereof until the sale to the Government has been effected, and thereafter deliver such hides, bagged and branded as required, f.o.b. ocean steamer at one of the following ports: Bluff, Dunedin, Port Chalmers, Timaru, Oamaru, Lyttelton, Wellington, Napier, Gisborne, Auckland, Waitara, Wanganui, Picton, Nelson, Tokomaru Bay, Whangarei.

13. For the purposes of this scheme the Government will, so far as may be thought necessary, grant licenses to fit and proper persons to purchase hides for resale to the Government under this scheme. Such licenses will be granted on application to the Minister of Agriculture, and on such terms and conditions and on the payment of such fees as he thinks fit to impose, and may be cancelled by that Minister if he is satisfied that any breach of such conditions has been committed by the licensee.

14. No hides will be purchased by the Government from any person who has himself purchased the same, unless he was already the owner thereof at the date of this notification, or unless he was at the time of purchase a dealer duly licensed as such by the Government.

15. Tanners carrying on business in New Zealand may, on application to the Controller of the Department of Imperial Government Supplies, be granted a permit to purchase from brokers, licensees of meat-export slaughterhouses, or managers of hide-stores attached to the public abattoirs named in clause 4, hides which are under offer of sale to the Government, provided satisfactory proof is furnished to the Controller of the Department of Imperial Supplies that such hides are necessary for the legitimate purposes of their business. The price to be paid for the hides shall be based on the values determined by the Government valuer in accordance with the scale of values shown in the Second Schedule. Every tanner so applying must furnish with his application a statement showing the number of hides of each quality, according to the Third Schedule, which he has stored on his premises or elsewhere, or which he has agreed to purchase at the date of his application. He shall further furnish a similar return on the first day of each month thereafter to the Controller of the Imperial Government Supplies Department

16. In all of the matters herein set forth the Minister of Agriculture will act on behalf of the Government either by himself or by such person or persons as he may nominate in that behalf.

17. If such supplies of hides as the Government deems adequate for the necessities of His Majesty's Government are at any time not obtained by way of contract of purchase and sale in accordance with the foregoing provisions, the necessary supplies will thereupon be obtained by way of seizure or requisition in the exercise of His Majesty's prerogative, or in pursuance of the powers conferred by the Regulation of Trade and Commerce Act, 1914, or the War Regulations Amendment Act, 1915 (No. 2), as the case may require.

FIRST SCHEDULE.—GOVERNMENT BROKERS.

Abraham and Williams (Limited).
A. Buckland and Sons.
A. Moritzson and Co.
Bennett and Sherratt.
Bisley Bros. and Co.
Buxton and Co. (Limited).
Canterbury Farmers' Co-operative Association (Limited).
Common, Shelton, and Co. (Limited).
Dalgety and Co. (Limited).
Darling and McDowell.
De Pelichet, McLeod, and Co. (Limited).
Donald Reid and Co. (Limited).
Freeman R. Jackson and Co.
Friedlander Bros. (Limited).
Guinness and Le Cren.
G. W. Binney and Sons.
Hawke's Bay Farmers' Co-operative Association (Limited).
Henderson and Co. (Limited).

FIRST SCHEDULE.—GOVERNMENT BROKERS—*continued.*

H. Matson and Co.
Hugh Roberts.
J. E. Watson and Co. (Limited).
J. G. Ward and Co. (Limited).
J. J. Corry and Co.
Johnston and Co. (Limited).
H. A. Lloyd.
J. A. Miller.
J. R. Mills and Son.
L. A. Nolan and Co.
Levin and Co. (Limited).
Murray, Roberts, and Co. (Limited).
National Mortgage and Agency Company (Limited).
Newton King.
New Zealand Farmers' Co-operative Association (Limited).
New Zealand Farmers' Co-operative Distributing Company (Limited).
New Zealand Loan and Mercantile Agency Company (Limited).
North Auckland Farmers' Co-operative (Limited).
North Otago Farmers' Co-operative Association (Limited).
Otago Farmers' Co-operative Association (Limited).
Pyne and Co.
Southland Farmers' Co-operative Association (Limited).
Stronach, Morris, and Co. (Limited).
Todd Bros. and Co. (Limited).
United Farmers' Co-operative Association (Limited).
Wairarapa Farmers' Co-operative Association (Limited).
Waters, Ritchie, and Co.
W. E. Clouston and Co. (Limited).
Williams and Kettle (Limited).
Wright, Stephenson, and Co. (Limited).

Together with such other persons as the Government may from time to time appoint.

Receiving-depots.—Receiving-depots will be established at the following places: Auckland, New Plymouth, Stratford, Wanganui, Feilding, Palmerston North, Gisborne, Napier, Dannevirke, Masterton, Wellington, Nelson, Blenheim, Christchurch, Ashburton, Timaru, Oamaru, Dunedin Gore, Invercargill.

SECOND SCHEDULE.—SCALE OF VALUES.

	Per lb. s.	d.
Ox-hides, first quality, over 45 lb. up to freezing companies' best standard..	1	1
Others, first quality	1	0
Ox-hides, second quality	0	11½
Cow-hides, first quality, up to freezing companies' best standards ..	1	0
Others, first quality	0	11
Cow-hides, second quality	0	10½
Bull-hides, good quality	0	9

All other grades and qualities, including cut and slippy hides, to be fixed at relative valuations.

THIRD SCHEDULE.—CLASSIFICATION OF WEIGHT OF HIDES IN THEIR RESPECTIVE QUALITIES.

Ox-hides.

1. 33 lb. to 44 lb.
2. 45 lb. to 52 lb.
3. 53 lb. to 59 lb.
4. 60 lb. to 69 lb.
5. 70 lb. and over.

Cow-hides.

6. 33 lb. to 39 lb.
7. 40 lb. to 48 lb.
8. 49 lb. and over.

Yearlings.

9. 17 lb. to 24 lb.
10. 25 lb. to 32 lb.

Calves.

11. 5 lb. and under.
12. 6 lb. to 10 lb.
13. 11 lb. to 16 lb.

The above-mentioned Order in Council prohibiting the export of hides and calf-skins allows one exception, as follows: In the case of hides submitted for sale to the Government and rejected by the Government valuer as not being of good marketable quality or in good marketable condition, the Minister of Customs may grant a permit to export such hides to British possessions only. Such permit will only be granted subject to the rejected hides remaining, up to the time of shipment, under the supervision of Government officers, or such other person or persons, as may be appointed by the Government for the purpose.

HIGH COMMISSIONER'S CABLED MARKET REPORTS.

London, 17th March, 1917.

Meat.—Owing to decreasing supplies of Home-killed mutton and beef there is a better demand for all descriptions of frozen meat, with the result that Argentine mutton and lamb prices are higher. New Zealand mutton and lamb are in small supply; prices are unchanged. New Zealand and Australian mutton, per lb., 8⅝d.; ewe mutton 8½d. Argentine mutton, heavyweight 11⅜d., lightweight 11½d. New Zealand lamb 10d.; Argentine lamb 13d. New Zealand bull beef, hinds 9d., fores 8½d.; small supplies. Argentine beef in fair supply; chilled, hinds 11⅝d., fores 10½d.

Butter.—Prices have an easier tendency. Demand is mostly for salted butter; unsalted butter in slow demand; no arrivals. New Zealand, per cwt., 218s. to 224s.; unsalted 216s. to 220s. Australian 206s. to 214s.; unsalted 204s. to 212s. Argentine 204s. to 206s. American creamery 214s.

Cheese.—Market continues firm. Stocks are very light. Canadian white and coloured, per cwt., 162s.; States flats 160s.; English cheddar, no quotations, no supplies available.

Hemp.—Market firm with an upward tendency. There is a general and active demand owing to stock being almost exhausted. New Zealand good-fair, per ton, £73; fair £70. Manila fair £92; coarse £77. March to May shipment, New Zealand good-fair £71; fair £68; Manila fair £90; coarse £75. These prices are obtainable if shipment can be guaranteed.

Wheat.—Market firm with improved demand. Very little offered in market. Australian, per quarter, 84s.; Canadian 82s.; Argentine 81s.

Oats.—Market active and advancing; supplies are decreasing. New Zealand, per quarter, 52s.

24th March, 1917.

Meat.—All descriptions of frozen meat are in active demand owing to short supply. Only a small quantity under Government control has been released each week for home consumption. New Zealand mutton 8⅝d.; ewe mutton 8½d. Argentine mutton, heavyweight 11½d; lightweight 11⅞d. New Zealand lamb 10d.; Argentine lamb 13d. New Zealand and Argentine beef, no supplies available. Pork 11d.

Butter.—Maximum prices are unchanged for both butter and cheese, and will remain in force until 13th April. Lower prices are being quoted for colonial butters. Buyers are holding back, partly owing to uncertainty of maximum prices. New Zealand, unsalted 204s. to 212s.; salted 210s. to 218s. Australian, salted 202s. to 208s.; unsalted 200s. to 204s. French 212s. to 217s.

Cheese.—The market continues firm. Canadian white and coloured 162s.; English cheddar 165s.; Dutch cheddar 150s.; States flats 160s.

Hemp.—The market is firm at the advance; supply falls short of the demand; quotations are nominal. New Zealand, good-fair £74; fair £70. Manila fair £93; coarse £78. March to May shipment, New Zealand, good-fair £72; fair £69. Manila fair £93; coarse £77.

Wheat.—The market is strong; all stocks advancing; very limited supply. Australian 84s.; Canadian 82s.; Argentine 81s.

Oats.—Market remains firm. New Zealand 53s.

31st March, 1917.

Meat.—The demand is in excess of supply for all descriptions of frozen meat. Government has released only a small quantity. New Zealand mutton 8⅞d.; ewe mutton 8½d. Argentine mutton, heavyweight 12d.; lightweight 12¼d. New Zealand lamb 10d.; Argentine lamb 13½d. New Zealand beef, no supplies available. Argentine beef in good supply; chilled, hinds 11⅜d.; fores 10¼d. New Zealand boneless beef 11½d.

Butter.—The market is firmer, partly owing to New Zealand butter being in small supply. Danish, in fair supply, 218s. to 224s. Dutch creamery 204s. to 208s. New Zealand, salted 216s. to 220s.; unsalted 208s. to 212s. Argentine 198s. to 202s. Australian, salted 204s. to 206s.; unsalted 200s. to 204s.

Cheese.—No quotations owing to short supply, with the exception of States flats, in keen demand, 160s.

Hemp.—Spot market is strong. Good demand for all descriptions. Market active owing to small arrivals. New Zealand, good-fair £75 10s. fair £72. Manila fair £96; coarse £79. April to June shipment, New Zealand, good-fair £73; fair £71. Manila fair £95; New Zealand coarse £78. Output of hemp from Manila for fortnight ending 17th March was 37,000 bales.

Wheat.—Market firm with hardening tendency. There is a general and active demand, but very little is offered. Australian 85s; Canadian 83s.; Argentine 82s.

Oats.—Market looks very strong. There are a number of buyers at present price of New Zealand—54s.—but almost nothing offered for sale.

5th April, 1917.

Meat.—There is no material change in the market, with the exception that prices are higher for Argentine mutton and lamb, owing to the continued small supply of New Zealand mutton and lamb. New Zealand mutton 8¾d.; ewe mutton 8½d. Argentine mutton, heavyweight 12½d.; lightweight 12½d. New Zealand lamb 10d.; Argentine lamb 14d. New Zealand beef, no supplies available; New Zealand boneless beef 11½d. New Zealand pork for the Government 10½d. Argentine chilled beef, hinds 11⅝d.; fores 10⅝d.

Butter.—The market is easier. Danish prices are lower, 218s. to 222s. Australian, salted 198s. to 202s.; unsalted 196s. to 200s. New Zealand, salted 214s. to 218s.; unsalted 208s. to 210s. Argentine 196s. to 200s.

Cheese.—No quotations owing to short supply, with the exception of States flats 160s. Estimated Canadian and States cheese-stocks, London, Liverpool, and Bristol, 50,000 boxes, against 97,000 at same time last year. Estimated New Zealand and Australian cheese-stocks, London and Bristol, nil crates, against 28,000 at same time last year.

Hemp and Grain.—No change in the markets.

14th April, 1917.

Meat.—Although Argentine mutton and lamb are in fair supply, prices are higher owing to continued small supplies of New Zealand mutton and lamb and Australian lamb. Lower prices are being accepted for good supplies of home-killed mutton and beef and Argentine beef. New Zealand mutton 8¾d.; ewe mutton 8½d. Argentine mutton, heavyweight 12½d.; lightweight 12½d. New Zealand lamb 10d.; Argentine lamb 14½d. Argentine chilled beef, hinds 11d., fores 9¾d.

Butter.—The following maximum prices have been fixed for the next two weeks: Danish and finest New Zealand salted 220s.; Dutch creamery, Australian, Irish creamery and American creamery 214s; Argentine 210s. The market is easier, partly owing to good supplies of Australian and Danish. Danish salted 204s. to 208s.; New Zealand salted 200s. to 208s., unsalted 198s. to 200s.; Australian 190s. to 194s.; Argentine 186s. to 194s.

Cheese.—In active demand owing to short supplies. Canadian 162s.; States flats 160s. Maximum cheese prices remain unchanged.

Hemp.—Market remains firm, as offerings are very small on account of freight difficulties. Quotations are nominal. Good-fair New Zealand £75 10s., fair £72; fair Manila £96, coarse £79. April to June shipments, good-fair New Zealand £73, fair £71; fair Manila £95, coarse £78.

Wheat.—Market firm. Demand is greater than the supply. Australian 85s.; Canadian 83s.; Argentine 82s.

Oats.—Market is strong, and all stocks are advancing. There is a general and active demand. New Zealand 55s.

Peas.—Market firm with an upward tendency.

Beans.—Market firm owing to reduced supplies.

Price of Milk in Wellington Area.—The Order in Council of 18th January, 1917, which fixed the maximum wholesale price of milk for retail distribution within the City of Wellington and the adjoining boroughs and counties at 10½d. per gallon, was revoked by a fresh Order, gazetted under date 14th March, fixing such price at 1s. 0½d. per gallon.

STOCK EXPORTED.

THE following table shows the numbers and descriptions of stock exported from the Dominion during the month of March, 1917:—

Port of Shipment.	Horses.		Sheep.			Cattle.		Pigs.	
	To Australia.	To Eastern Pacific.	To Australia.	To Eastern Pacific.	To San Francisco.	To Australia.	To Eastern Pacific.	To Eastern Pacific.	To Australia.
Auckland ..	..	10	..	106	..	..	16	35	..
Gisborne ..	..	..	..	..	..	..	..	..	..
Napier ..	..	..	..	..	..	11	..	..	..
Wellington ..	12	..	5	100	..	13	..	..	..
Lyttelton ..	20	..	508	..	..	15	..	..	..
Dunedin ..	..	..	..	..	..	..	..	..	..
Bluff	..	..	..	..	..	..	..	..	..
Totals ..	32	10	513	206	..	39	16	35	..

The following are particulars of horses shipped: Draught, 2 stallions, 2 mares, gelding; hack, 5 mares; pony, 2 mares, 1 gelding; thoroughbred, 1 stallion, 9 colts, 4 geldings, 4 fillies; Clydesdale, 5 stallions, 4 mares, 2 colts.

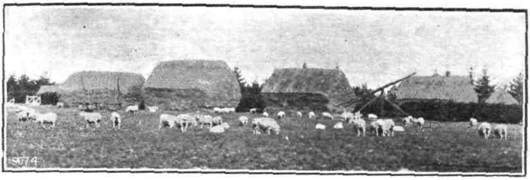
STOCK IN QUARANTINE.

THE following stock was received into quarantine during the month of March, 1917:—

No.	Description.	Sex.	Port of Origin.	Owner or Agent.	Address.
			SOMES ISLAND (WELLINGTON).		
1	Terrier dog ..	Male ..	San Francisco	Rosa Watkins ..	Wellington.
1	Jersey bull-calf	,, ..	London ..	C. Goodson ..	Hawera.
			QUAIL ISLAND (LYTTELTON).		
3	Collie dogs ..	Male ..	London ..	J. Lilico ..	Lochiel.
1	Border Leicester ram	,, ..	,, ..	J. Douthwaite ..	Waimate.
2	Border Leicester ewes	Female	,, ..	,, ..	,,
1	Border Leicester lamb	Male ..	,, ..	,, ..	,,

FORTHCOMING SHOWS.

National Patriotic Apple Show, 1917: At Dunedin, 1st to 4th May.
Southland A. and P. Association: Winter Show at Invercargill, 15th to 17th May.
Otago A. and P. Society: Winter Show at Dunedin, 29th, 30th, 31st May, and 1st June.
Waikato Winter Show Association: At Hamilton, 5th to 9th June.
Manawatu and West Coast A. and P. Association: Winter Show at Palmerston North, 19th to 22nd June.
South Taranaki Winter Show Company (Limited): Dominion Dairy Show at Hawera, 2nd to 7th July.



The

Journal of Agriculture.

WELLINGTON, NEW ZEALAND.

21ST MAY, 1917.

NOXIOUS WEEDS IN NEW ZEALAND.

NOTES ON A RECENT INQUIRY.

A. H. COCKAYNE, Biologist.

TOWARDS the end of last year the Board of Agriculture distributed a large number of circulars to farmers' organizations and to individual farmers throughout the Dominion for the purpose of obtaining a definite expression of opinion as to which were the most serious weeds of both arable and pastoral land in the different districts, and at the same time to secure data concerning the varying methods of control adopted. Over eight hundred replies were received and much valuable information obtained. A good deal is especially valuable as a permanent record of the present opinion with regard to specific weeds, but a certain amount of general information can be gleaned from the reports, especially on the main aspects of weed-control in general.

NEED FOR A DETAILED WEED-SURVEY.

The very contradictory statements made by individual farmers in the same locality show that in many cases the type of land and the

utilization to which it is put has a great bearing on the farmer's individual opinion as to what constitute the worst weeds and what methods should be adopted. From this it appears highly necessary that a proper weed-survey should be undertaken by the Department. In this work special attention should be given to the type of ground on which weeds are a serious source of loss, and to the general types of management that should be adopted and which are practicable. During the course of such a survey each field officer concerned could map out with a fair degree of accuracy the different types of ground and different methods of soil-utilization in his district that call for different methods of control, even for the same weed in the same district. In this way a good deal of the difficulty at present existing in dividing the country into zones where different types of weed-control should really be carried out could be got over. Each officer could carefully consider and get all the different methods adopted, and suggest improvements in the type of farm-management that would increase the efficacy of any method. Finally, when the work was completed, a weed-map of each district could be worked out and reasonable methods of control formulated for different areas.

LOCAL CONDITIONS AND ENVIRONMENT.

Again and again in the reports was shown the fact that it is the environment of any particular weed in question that decides what method of control, if any, should be adopted, and not the mere presence of the weed itself. In many instances the replies indicated that certain weeds are comparatively harmless under one set of soil and climatic conditions, and are most serious and virtually impossible to control when occurring under other conditions. For instance, over large areas of the eastern coast of the South Island blackberry is virtually a weed of no moment and yields to treatment which on the wetter west coast—where it is the most serious of all weeds—is either quite inapplicable or inefficacious. Yarr (or spurrey), one of the most serious of arable-land weeds in Southland, is in the neighbouring district of Central Otago, where the climatic conditions are essentially different, quite negligible from the farmer's point of view. Again, one of the Southland methods of dealing with underground-stemmed grasses (twitches) by deep ploughing and preparation of the upturned surface for cropping is quite useless in certain other parts of New Zealand. However, probably the most important feature in the replies in general is that even in districts where a weed is particularly serious the type of farming followed and the physiography of the individual farm entirely determines the character of the control that can be adopted.

This supports the view that the noxious-weeds question, although as a whole of a national character so far as its efficient control is concerned, is governed by local conditions and requirements which may often vary even on an individual farm. From this it is clear that before the noxious-weeds problem can be brought to the point of satisfactory solution an immense amount of local and accurate data must be secured, and it is for this end that a thorough weed-survey of the whole Dominion is urged. From the information already to hand it seems quite impossible on practical grounds to hope for any generally applicable methods of weed-control. On biological grounds any such attempt is unsound. It is, however, more than probable that with a more extended knowledge of the various factors influencing and retarding weed-development practical methods for their control could be formulated; but it is likely that most of such methods will be in the direction of special applications of farm-management rather than actually direct mechanical methods of control. It is likewise clear that no hard-and-fast rules for the control of weeds can be made even for individual districts, although a more or less generalized mode of procedure may be adopted, provided both the natural and the controllable environment of the weed in question is comparatively uniform.

THE EFFECT OF THE NOXIOUS WEEDS ACT.

Peculiar as it may seem, the replies as a whole show that the Noxious Weeds Act has had a most remarkable effect on the commonsense and individuality of the farmer himself. The Act implies that cutting so as to prevent flowering is the basis of all weed-control. Thus in a very large number of cases the only method given for the control of weeds gazetted as noxious was to cut down, so as to avoid flowering—the farmer realizing that the acceptance of this procedure satisfied the present inspectorial system. In marked contrast were the replies as to control of weeds such as couch-grasses, yarr, bracken, water-fern, piripiri, manuka, and other plants not included in the Act. In such cases the replies indicated an intelligent appreciation of practical methods of reducing the loss of production due to these weeds. The value of sound management directed towards actually controlling such weeds was emphasized, and in no case was satisfying the provisions of an Act of Parliament the objective desired. In my opinion, this was, on the whole, the most remarkable feature of the replies in general. Another very noticeable point was that certain gazetted noxious weeds, especially Californian thistle, were mentioned as the most serious weeds of the district, irrespective of whether they were causing any appreciable harm or not. In many cases, after the enumeration of this thistle as the worst weed of the district, a footnote was appended to the effect that little, if any, of

the weed existed in the district. This widespread fear of Californian thistle was most noticeable in districts where it is not as yet particularly abundant. In those where it is abundant it is evidently held in less dread.

As was to be expected, very contradictory opinions on the value of cutting down annually such weeds as Californian thistle and blackberry were expressed in the replies, even from the same district. In certain cases cutting alone was advocated and said to be effective, but the reverse was stated in the majority of cases. Really scientific evidence on the value of cutting is much wanted, and in all cases it should be correlated with the exact conditions to which the weeds are subjected.

Many of the answers showed that the average farmer was very desirous of controlling weeds in every case where measures could be profitably adopted, but showed a strong reluctance to deal with land where control was simply directed towards a reduction in flowering without any other direct benefit being secured.

THE PREVENTION OF INFECTION FROM INFESTED TO CLEAN LAND.

It was very remarkable that in the majority of cases very little stress was laid on the necessity of control on what is virtually waste land or completely weed-infested land. The theory that control should be directed to avoid further infection had comparatively few advocates except in certain districts, notably in the wheat area of the South Island. The actual repression of weeds and future profitable employment of badly infested areas, provided the work was practicable, was emphasized in many replies—that is, the improvement in *utility* of weed-infested areas was the dominant note struck. This, of course, is to be expected from farmers who deal more with the individual than the national aspect of weed-control. But if individual effort directed against weed-repression—that is, more or less complete eradication—becomes general, then it follows that the national aspect is more fully satisfied than under the present system. It was notable, however, that farmers not particularly troubled with weeds were desirous in most cases of making their less fortunate brethren carry out the Act in its entirety.

The question of the frequent non-cutting of weeds on Crown and Native land was frequently dealt with, and the consensus of opinion was that the work of cutting should be rigorously carried out, but in only few instances did the private owners suggest that they should carry out the same method on their own properties. It was noticed, however, that in but few instances was there any suggestion that the Act should be repealed, but that it should be virtually inoperative over certain types of privately owned country was repeatedly contended. The desire for information on rational methods of suppres-

sion, especially with weeds not scheduled in the Act, was very general, and indicates once more the urgent need of a proper weed-survey dealing with all phases of the subject.

MAIN WEEDS REPORTED IN ORDER OF IMPORTANCE.

For the purpose of this analysis 669 replies were selected from the 800 received. The remainder were in most cases so incomplete as to be of no value. The results are tabulated as follows :—

North Island (341) replies.		*South Island* (328 replies).	
Weed.	Times reported.	Weed.	Times reported.
Blackberry	304	Californian thistle	262
Californian thistle	249	Couch-grass	150
Gorse	179	Fat-hen	133
Ragwort	162	Yarr	130
Ox-eye daisy	141	Sorrel	99
Pennyroyal	123	Sweetbrier	94
Foxglove	70	Gorse	93
Piripiri (hutiwai)	56	Dock	82
Winged thistle	42	Ragwort	80
Sorrel	39	Blackberry (27 Nelson)	60
Variegated thistle	37	Broom	51
Buttercup	32	Yarrow	48
Bathurst burr	23	Wild turnip	45
Fat-hen	21	Ox-eye daisy	36
Inkweed	20	Shepherd's-purse	30

It will be noted that of the above fifteen main weeds of the South Island ten are arable-land weeds and five pasture weeds, while in the North Island thirteen of the fifteen main weeds are pasture weeds. This is, of course, to be expected when the difference in farm practice between the two Islands is considered.

WEED DISTRICTS.

An attempt (based on the replies dealt with) is made here to divide New Zealand into districts, giving the three main weeds of each in order of importance :—

District.	Main Characteristic Weeds.
Auckland	Blackberry, gorse, pennyroyal.
Tauranga	Blackberry, Californian thistle, ragwort.
Waikato	Blackberry, Californian thistle, gorse.
King-country	Blackberry, Californian thistle, inkweed.
Hawke's Bay	Blackberry, Californian thistle, variegated thistle.
Taranaki	Blackberry, ragwort, pennyroyal.
Forty-mile Bush	Californian thistle, blackberry, ragwort.
Manawatu, Rangitikei	Californian thistle, pennyroyal, blackberry.
Wairarapa	Gorse, Californian thistle, winged thistle.
East Nelson, South Wellington	Blackberry, foxglove, Californian thistle.
Kaikoura, Blenheim	Californian thistle, sweetbrier, gorse.
Canterbury	Couch-grass, Californian thistle, fat-hen.
Central and North Otago	Californian thistle, fat-hen, sorrel.
Southland and South Otago	Californian thistle, yarr, ragwort.

Not sufficient replies were received from Westland or North Auckland to give any specific details for those districts.

METHODS OF CONTROL.

The replies require very careful tabulation with regard to suggested methods of control, and a number need special consideration. Many of the answers, to any one knowing the country, are manifestly impracticable, but in other cases much useful information is given. In future issues of the *Journal* it is proposed to deal separately with the weeds enumerated in the circulars. It is thought that this work when completed will serve as a basis on which to conduct a proper weed-survey.

One fact, however, is patent, and that is that weed-control in New Zealand must have as its immediate object the lessening of damage on the land actually occupied by weeds, or, as it may be expressed, the proper breaking-in of weed-infested country where feasible. The great sheet-anchor of the *in toto* supporters of the present Noxious Weeds Act—that its primary objective is the protection of clean country by the cutting-over of infested land — must be partly abandoned. With proper attention the clean land can be kept clean, but this, on financial grounds alone, cannot be done merely by attempting to stop the spread of weeds from affected country by cutting them. Over vast areas of New Zealand the cost would be prohibitive. The aim of all future weed-control is individual effort directed towards reducing the effects of weeds on individual holdings. No single method of control is possible, but with the employment of sound methods of farm practice directed towards weed-repression the individual will greatly reduce his loss by weeds, and if well-thought-out methods of repression, varying in accordance with soil; climate, and the method of soil-utilization, are generally adopted the weed problem should in time disappear.

CO-OPERATIVE FRUIT-TESTING.

THE TASMAN AREA.

W. C. HYDE, Orchard Instructor, Nelson.

A FEW years ago the Department arranged to co-operate with fruit-growers' associations and individual growers in planting small areas of approximately an acre in various varieties and classes of fruit-trees, with a view to ascertaining those best suited for the different districts. The conditions of the scheme are as follows: The association or orchardist provides the land and attends to the cultivation, spraying, &c., while the local Orchard Instructor carries out the pruning and generally supervises the work; the Department also provides all trees, manures, spraying-materials, &c.

The number of test areas planted under these conditions has now reached sixty-five. One of the earliest was established on Mr. Arthur McKee's property at Tasman, Moutere Hills, in 1911. The site of this area is on a broad sloping spur some 200 ft. above sea-level. Six years' experience with some of the varieties planted forms a basis on which certain conclusions may be established. In the case of other late-maturing varieties a longer period will be required before a fair decision can be given.

The following are brief notes on trees of the area as they stood towards the end of March last:—

APPLES.

American Summer Pearmain.—A pretty little tree and crop, but hardly commercial; crop ripe in February. Some water-core.

White Winter Pearmain.—Carrying a bushel of fruit. Vigorous, promising tree. No aphis showing. (Considerable aphis in the locality.)

Pomme de Neige.—Fruit flushed red; white flesh; quarter-bushel crop. Good moderate growth; spurs well. Little aphis showing. Ripe early in March.

Cox Orange.—The high quality of this season's crop has abo t regained its reputation. Quarter-bushel of fruit picked at the end of February.

William Anderson.—Vigorous; blight-proof. Dark, unattractive apple, without flavour; late maturing. Crops on the laterals; quarter-bushel of fruit to the tree.

Esopus Spitzenburg.—Spurring freely. Some aphis. Quarter-bushel crop. Rather coarse sample.

Rambo.—An improved Spitzenberg; a better tree.

Delicious.—Holding its own; clean and vigorous.

Sturmer.—Similar to the foregoing. Carrying about a bushel of clean fruit.

Late Gravenstein.—Nothing to recommend it so far.

Jonathan.—Holding its own. Half-case of 3 in. fruit of good clean quality.

King David.—Half-bushel of $2\frac{3}{4}$ in. apples; colour perfect. A commercial apple for the hill country.

Cleopatra.—A failure here; giving too much work to cope with black-spot.

Gravenstein.—Deserves a place. Growth and habits here typical of the variety. This year's crop consists of a couple of dozen apples, ripe in January.

Mona Hay.—The specimens here show no promise.

Coldstream Guard.—A poor cropper. Spurs poorly.

Scarlet Pearmain.—Clean; spurring well; growth good. Crop, quarter-bushel. Very attractive; worth consideration.

Loy.—Average growth. Little aphis. A cooker. Moderate bearer. Probably unsuitable here. Ripe in March.

Climax.—Vigorous grower, without spurs or crop.

Parlin's Beauty.—Growth of light colour and unusual vigour, this six-year tree being 9 ft. in height. Spurs freely formed on leaders and laterals. Fruit 3 in. of round shape inclined to conical, irregular; colour yellow with deep blush; stem of moderate length and thickness, in steep shallow basin; eye convergent in shallow basin; flesh firm and juicy, of good quality; ripe about the end of March. Crop, nearly 2 bushels. An outstanding success.

Rhodes Orange.—No crop. Without spurs. Clean. Unshapely tree.

Salome.—Growth below the average. No aphis. Spurring freely. Quarter-bushel of nice fruit, ripe about April.

Ballarat Seedling.—Characteristic habit, but of quite moderate growth; carrying twenty large apples.

Wright's Perfection.—Badly affected with aphis. Not a commercial apple here.

Scarlet Queen.—Tree undersized; spurring freely. Clean. A couple of dozen apples of attractive appearance—some water-cored; ripe early in March.

Rymer.—No crop. Quite moderate growth. Not promising on the hill country.

American Golden Pearmain.—An undersized tree of no promise here.

Statesman.—No crop, but an excellent tree, highly esteemed locally.

Barry.—Little to recommend it. A lateral bearer. Ripe in February.

Dumlow's Seedling.—Tree of nice habit, vigorous; fruit moderate quality, showy; thick fleshy stem. Apple here ripe about March.

Red Majestic.—No crop. Moderate growth; few spurs.

D'Arcy's Spice.—Growth short. Moderate crop on laterals.

Stayman's Winesap.—Very much the habit of Gravenstein; but wants further testing here.

The Queen.—Apples of exceptional size, but few in number. Short, vigorous growth. Not commercial here. Ripe in March.

Marshall's Red.—Without flavour; highly coloured; subject to water-core; ripe in February. Small crop; vigorous growth. Unsuitable for extensive planting here.

Golden Pearmain.—Good flavour. Spurring well; nice vigorous tree, free from aphis. Ripe in February.

Wealthy.—Big tree and six large fruit—1 lb. in weight in some instances; ripe in March. Some aphis.

Edward Lippiatt. — Strong dark foliage and wood. A dozen apples borne on laterals; ripening late.

Edward VII.—Of average growth; badly affected with aphis. Quarter-bushel of fruit badly affected with bitter-pit; ripe end of March.

Foster.—Ripe in March; nice flavour and well coloured. Vigorous grower; spurring freely; affected with aphis.

Shiawasse Beauty.—Growth vigorous; spurs well. Tree carrying a good half-bushel of fruit, pale-yellow colour, much like Gravenstein but more shapely; flesh yellow, juicy, acid; ripe in February. A little black-spot and aphis showing.

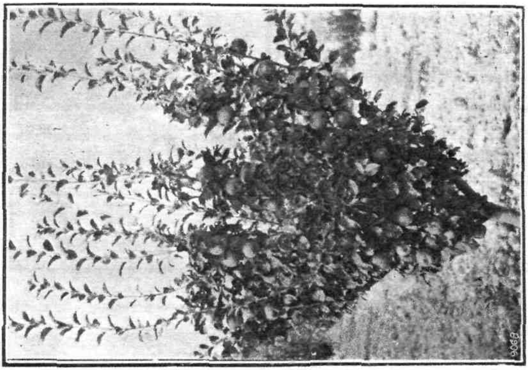
Thomas Rivers.—Dark, speckled, vigorous growth; spurs well. Early maturing. Carrying three-quarter bushel of 3 in. fruit; ripe middle of February; shape round, irregular, with bright stripes; eye, sepals converge in shallow puckered basin; stem rather fine; ¾ in. long; flesh yellow, crisp, of good flavour; open core.

Liveland Raspberry.—Little that is creditable can be said of this variety.

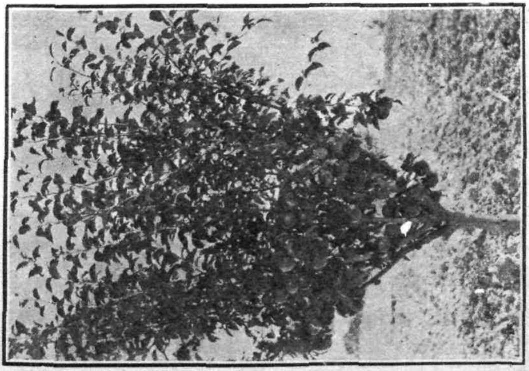
Cliff's Seedling.—Big tree, spurring well; carrying three apples that have been affected with black-spot; ripens late.

Dunn's (Munro's) Favourite.—Maintaining its position. A handsome tree, carrying a bushel of apples; good sample.

Surecrop.—Growth average; spurring freely. Crop small; fruit large, of second quality; some black-spot.



SHIAWASSE BEAUTY.



PARLIN'S BEAUTY.

Winterstein.—No fruit. Nothing promising about it.

Alfriston.—A well-shaped tree, carrying half a bushel of good cookers.

Ben Davis.—Vigorous growth, cropping on the laterals; crop, quarter-bushel of poor quality.

Lady Carrington.—Good clean growth. Moderate crop of bright apples of conical shape; ripe end of February.

England's Glory.—Excellent growth. Moderate crop of shapely yellow fruit.

Early Joe.—Growth moderate and clean. Crop poor; fruit small; ripe in January.

Pioneer.—Vigorous dark wood. Fruit $2\frac{3}{4}$ in., of short conical shape; eye convergent in small shallow basin; stem thin, rather long; colour yellow, heavily flushed with red; flesh of good quality. An improved Rokewood.

Willie Sharp.—Growth vigorous, with light-coloured bark; spurring freely. The tree carries three-quarter bushel of $2\frac{3}{4}$ in. shapely fruit of lemon-yellow colour, occasionally flushed with pink, with thin russet round the stem; eye convergent in deep, narrow basin; stem long and slender, similarly situated; flesh yellow, crisp, juicy, and undoubtedly good: ripe early in February.

Senator.—Vigorous brown speckled wood, spurring well. Showy apple of very fair quality; ripe early in March. A variety with some possibilities in this district.

Macintosh Red.—Carrying half-bushel of highly coloured fruit; ripe in February. Fine-grained flesh of good quality. Growth moderate. Worth more consideration.

Lord Wolseley.—Of moderate growth; carrying about a dozen nice apples.

Taupaki.—A vigorous tree without spurs; carrying a few dark, striped apples on laterals; ripe in January.

Dillington's Beauty.—Growth poor; spurring well. Carrying half-bushel of fruit of good quality; ripe in March.

Champion.—A tall, straggly tree, carrying a dozen fruits.

Reinette Du Canada.—Carrying quarter-bushel of well-coloured fruit. Maintaining its well-known reputation.

Crisp's Russet.—A well-furnished, thrifty tree. A good half-bushel of fruit on 6 ft. of growth.

Five-crown.—A good sample of fruit, but unsatisfactory growth.

Yates.—(Four-year.) The well-known speckled wood, in fair vigour. Crop, half-bushel of $2\frac{1}{2}$ in. apples.

Lane's Prince Albert.—(Four-year.) Half-dozen fine fruits on a small tree of awkward growing habit.

Shoreland Queen.—(Four-year.) 6 ft. high, with a dozen handsome fruits.

Buncombe.—(Four-year.) 5 ft. of vigorous growth, with quarter-bushel of showy fruit.

Wagner.—(Four-year.) Well-coloured foliage on vigorous, speckled timber. Carrying a quarter-bushel of fruit in the base of the tree.

PEARS.

Williams Bon Chrétien.—A handsome, thrifty tree, carrying a bushel of 3 in. fruit; ripe early in February.

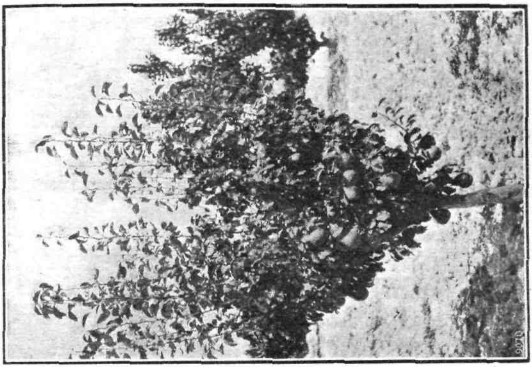
Howell.—Vigorous, shapely growth. Heavy, clean crop of 3 in. fruit, much like Williams Bon Chrétien in shape; colour yellow with russet dots, occasionally flushed red when exposed; good dessert. Comes in soon after Bon Chrétien.

Beurre Clairgeau.—The tree on this area is a handsome specimen, carrying a bushel of even 3 in. fruit.

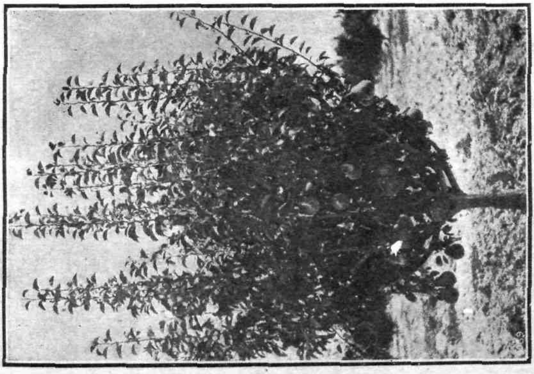
Madame Lang.—A vigorous, shapely tree, carrying three-quarter bushel of 3 in. fruit. Shape of fruit, obtuse cone of yellow colour covered with thin russet, crimson blush where exposed to sun; stem strong, moderately long; eye open in shallow basin; ripe about end of March.

SOME SUMMARIZED CONCLUSIONS.

From the foregoing it will be seen that the extensive planting of the apples Dunn's (Munro's) Favourite, Delicious, Sturmer, Jonathan,



HOWELL.



WILLIAMS' BON CHRETIEN.

and Cox Orange by the early planters is endorsed by this experimental area, those varieties easily maintaining their position as being of special merit in this locality. During some seasons Cox Orange has been wasty and disappointing; this year the sample is excellent, and has done much to retain the variety in its high position on the list of commercial apples. The test further reveals the fact that the apples King David, Parlin's Beauty, Statesman, Macintosh Red, Senator, Salome, Gravenstein, Scarlet Pearmain, White Winter Pearmain, Willie Sharp, and Pioneer are also worth the careful attention of intending planters on these slopes of the Moutere Hills.

Turning to the pears, the vigorous condition and early maturity of the five-year-old trees of the following varieties is of interest: Howell, Keiffer's Hybrid, Harrington's Victoria, Williams Bon Chrétien, Madame Lang, and Beurre Clairgeau. While the varieties Beurre Capiaumont and Durondeau lacked vigour, they carried a number of very handsome fruits. Other commercial varieties of pears making good thrifty growth of great promise are Winter Cole, Vicar of Winkfield, Glou Morceau, Winter Bartlett, Koonce, Madam Cole, P. Barry, Wilder, and Le Lectier; but these have not yet commenced to crop.

IMPORTATION OF FERTILIZERS.

ANNUAL RETURNS.

B. C. ASTON, F.I.C., Chemist to the Department.

THE returns of artificial fertilizers imported into New Zealand for the year ended 31st March, 1917, are now, by the courtesy of the Comptroller of Customs, available in the accompanying tables. These, as usual, are designed to show the returns of the year compared with those of the previous corresponding period.

The results, which are somewhat startling, disclose a net decrease of some 37,750 tons of phosphatic fertilizers imported. The decreases in this class were 26,000 tons of superphosphate, 14,000 tons of guano and rock phosphate, and 4,000 tons of basic slag. On the other hand, 6,000 tons more of Egyptian phosphate and 300 tons more of bonedust were imported. The decrease in the importation of phosphatic fertilizers, in which the soils of New Zealand, under the present system of farming, are in urgent need, is the outstanding feature of the returns and the one to be most regretted.

Only 9 tons of potash salts (exact nature unspecified) were imported. Of the nitrogenous fertilizers—an insignificant part of the whole — sulphate of ammonia shows a considerable decrease, and the small importations of nitrate of soda are stationary. Gypsum has increased by 1,700 tons, and the other items call for no special comment.

The following is a summary of the kinds, quantities, and values of the various fertilizers imported during the years ended 31st March, 1917 and 1916:—

—	Weight.		Value.	
	Year 1916-17.	Year 1915-16.	Year 1916-17.	Year 1915-16.
	Tons.	Tons.	£	£
Bonedust	10,386	10,059	60,769	64,177
Bone char	500	906	2,163	3,209
Blood manure	..	109	..	707
Blood and bone	750	808	5,227	5,570
Basic slag	6,660	10,339	19,931	38,892
Egyptian basic phosphate ..	8,614	2,026	33,157	7,562
Superphosphate	31,962	58,013	137,499	231,007
Guano and rock phosphate ..	24,993	39,366	46,621	96,449
Phosphate unspecified	251	2,139	1,010	4,144
Sulphate of potash	..	92	..	2,342
Kainit	..	4	..	81
Potash salts unspecified.. ..	9	..	359	..
Gypsum	9,830	8,182	10,020	12,010
Sulphate of ammonia	249	845	5,001	11,013
Nitrate of soda	645	659	8,952	6,842
Calcium cyanamide	65	181	844	2,050
Sulphate of iron	70	158	378	771
Manures unspecified	86	116	280	542
Totals	95,170	134,002	332,211	487,388

The declared import values per ton of the chief phosphatic fertilizers for the two years under review work out as follows:—

	Year ended 31st March, 1917. £ s. d.	Year ended 31st March, 1916. £ s. d.
Bonedust	5 16 0	6 7 6
Basic slag	3 0 0	3 15 0
Egyptian phosphate	3 17 0	3 15 0
Superphosphate	4 6 0	4 0 0
Guano and rock phosphate ..	1 17 6	2 9 0
Nitrate of soda..	13 17 6	10 7 6
Sulphate of ammonia	20 1 6	13 0 6

IMPORTATION IN TONS OF ARTIFICIAL FERTILIZERS TO NEW ZEALAND FOR

New Zealand Port of Entry.		Australia.					Belgium.			Germany (including Austria).				
		Nitrogenous Manures.	Bonedust and Blood and Bone.	Superphosphate.	Rock Phosphate and Phosphate unspecified.	Gypsum.	Nitrogenous Manures.	Superphosphate.	Basic Slag.	Nitrogenous Manures.	Superphosphate.	Basic Slag.	Phosphate unspecified.	Potash Manures.
Auckland ..	1917	56	1,406	4,789	583	420	..	..	..	..	..	..	..	..
,, ..	1916	292	4,713	11,013	152	890	..	..	..	..	170	..	..	..
Tauranga ..	1917	..	..	390	..	..	..	..	..	..	..	..	..	..
,, ..	1916	..	..	..	..	..	..	..	..	..	..	..	..	..
Poverty Bay ..	1917	..	..	..	..	..	..	..	..	..	..	..	..	..
,, ..	1916	..	..	..	..	..	..	..	..	..	..	..	..	..
New Plymouth ..	1917	..	..	1,477	230	20	..	..	..	..	..	..	..	..
,, ..	1916	32	..	1,415	340	..	..	..	..	..	..	..	..	..
Patea ..	1917	..	..	..	..	50	..	..	..	..	..	..	..	..
,, ..	1916	..	..	..	..	100	..	..	..	..	..	..	..	..
Wanganui ..	1917	..	..	1,898	1085	810	..	..	..	..	..	..	..	..
,, ..	1916	5	45	..	..	..	..	..	..	..	..	..	..	..
Wellington ..	1917	5	..	3,041	761	1,786	..	..	..	..	..	..	..	..
,, ..	1916	27	..	7,990	1081	430	..	..	..	..	102	..	..	..
Napier ..	1917	3	..	250	100	60	..	..	..	..	..	..	..	..
,, ..	1916	35	..	596	50	45	..	..	..	..	..	..	..	..
Wairau and Picton	1917	..	..	..	..	..	..	..	..	..	..	..	..	..
,,	1916	..	..	..	..	..	..	..	..	..	..	..	..	..
Nelson ..	1917	..	..	302	..	..	..	..	..	..	..	..	..	..
,, ..	1916	3	..	30	..	..	..	..	..	..	..	..	..	..
Lyttelton ..	1917	20	..	4,670	1275	4,532	..	..	..	..	..	..	..	..
,, ..	1916	152	..	7,893	1560	3,548	..	..	..	..	..	..	..	..
Timaru ..	1917	..	..	1,795	1661	1,850	..	..	..	..	..	..	..	..
,, ..	1916	..	10	3,330	950	1,040	..	..	..	..	..	..	..	..
Oamaru ..	1917	..	..	..	..	..	..	..	..	..	..	..	..	..
,, .	1916	..	..	675	..	300	..	..	..	..	..	..	..	..
Dunedin ..	1917	5	65	707	805	300	..	..	..	..	..	..	..	..
,, ..	1916	441	..	1,697	625	321	..	..	..	..	..	..	..	..
Invercargill ..	1917	170	650	5,937	699	..	..	..	..	..	..	..	..	..
,, ..	1916	477	874	1,416	1325	1,070	..	..	..	..	..	67	..	..

* Phosphate unspecified.

ENDED 31ST MARCH, 1917 AND 1916, SHOWING COUNTRIES OF DEPARTURE.

India.	Japan.	Pacific and Indian Ocean Islands.		Scandinavia.	United Kingdom.						United States.	
Bonedust.	Superphosphate.	Name of Islands.	Rock Phosphate.	Calcium Cyanamide.	Nitrogenous Manures.	Superphosphate.	Basic Slag.	Potash Manures.	*Phosphate unspecified.*	Iron Sulphate.	Nitrate of Soda.	*Iron Sulphate.*
7,405	901	New Caledonia .. Tuamotu Archipelago Seychelles Islands	2,037 8,273 545	..	..	..	3,452	..	27	..	..	..
4,490	*1,500*	*Seychelles Islands* *New Caledonia* .. *Tuamotu Archipelago* *Malden Island* ..	*2,500* *1,790* *15,673* *120*	..	..	*1,837*	*3,018*	*4*	*60*	.	*50*	..
..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	*24*	..	..	..	..	..	..
85	..	..	..	..	..	..	..	..	..	..	..	..
415	..	..	..	*40*	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..
400	..	..	..	61	..	1,757	3,033	..	..	..	..	..
141	*15*	*New Caledonia* ..	*1,000*	*115*	..	*641*	*6,154*	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..
..	*2,375*	..	..	*11*	..	*50*	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	New Caledonia ..	301	..	..	..	25	..	..	..	..	..
..	..	..	..	..	..	*30*	*100*	..	..	..	..	..
65	..	..	..	..	..	1,989	150	..	..	53	..	..
..	*3,195*	*Seychelles Islands* ..	*850*	..	..	*1,050*	*600*	..	..	*55*	..	*55*
..	2,056	..	..	..	..	3	..	..	..	..	..	..
200	*3,419*	..	..	*10*	..	*1,250*	..	..	..	..	..	*27*
..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	*18*
325	..	Tuamotu Archipelago	2,462	..	..	..	..	..	..	..	..	13
125	*104*	*Straits Settlements* *Seychelles Islands* *Tuamotu Archipelago*	*300* *11,000* *2,522*	*5*	..	*50*	*240*	..	..	..	..	..
785	..	Tuamotu Archipelago	1,475	..	..	..	..	..	..	..	..	..
675	*4,475*	*Madagascar* .. *Tuamotu Archipelago*	*3,410* *6,262*	..	..	*470*	*100*	..	..	..	..	..

PURCHASE OF "GOLDEN SWAN."

TO HEAD THE RUAKURA JERSEY HERD.

W. M. SINGLETON, *Assistant Director, Dairy Division.*

THE general tendency of dairymen and less general but nevertheless too frequent tendency of breeders of registered stock to set aside mature bulls, preferring those which are young, directs attention to the purchase of the mature Jersey bull Golden Swan by the Ruakura Farm of Instruction at the recent dispersal sale of the herd of Messrs. Moreland and Sons, Papatoetoe.

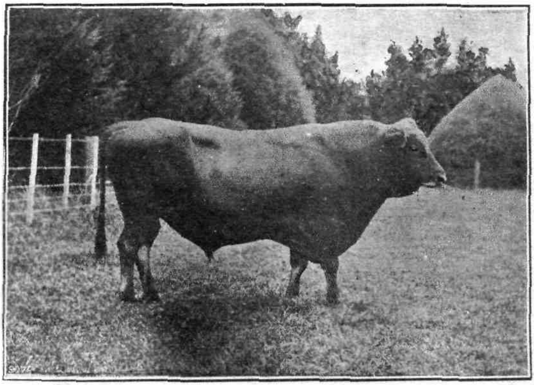
Golden Swan was born on the 22nd July, 1908, and was imported to the Dominion by Mr. A. Moreland. He is therefore between eight and nine years of age. In a climate such as that of New Zealand a bull's vitality and usefulness should be as great and as protracted as that of bulls of the same breed in North America, where cattle are stabled for no inconsiderable portion of their lifetime. Yet under these less propitious conditions we are informed that T. S. Cooper paid over $10,000 for Pedro, at six years of age, and used him until his twentieth year; that Financial King was at service in his sixteenth year; and that Interested Prince was at stud at fifteen years of age. Golden Fern's Noble was last year imported into the United States from the Island of Jersey when seven years old. His price was $25,000—a record for Jerseys. Among New Zealand bulls, K.C.B. was at service until his death a year since, when in his fifteenth year. Other such instances could be quoted, but these will suffice to show that Golden Swan should not be passed as too old.

It may be asked, "Why buy a mature bull?" The answer is, "To minimize risk." Some purchase a bull on conformation only. Others, more particular, buy on conformation and a knowledge of the pedigree. Others add to these two considerations a study of the records of production of the bull's dam and grandams, together with the types of these and near relatives. In buying a young bull this is about as far as a buyer can safeguard himself.

In buying a bull of the age of Golden Swan not only can the above-stated items be taken into account, but the supreme test can be applied. "By their fruits ye shall know them" is as true to-day as ever, and a study of the daughters of a bull constitutes a test which overshadows all others. This permits of an estimate of the bull's prepotency as evidenced in the producing-qualities of his daughters, their conformation, and uniformity of type.

CONFORMATION AND TYPE.

Some time ago the writer took measurements of a number of Jersey cows. Nearly all of these were, or had been, on test, and a number had won honours in the show-ring. Six to seven measurements were taken of each cow, with tape and a specially made rule for taking the height and the width at hip and pin-bones. A general inspection of the daughters of Golden Swan, together with a study of these figures, evidences splendid development of body, a good frame, and a specially well developed, evenly balanced, and uniform class of udder—well carried forward, wide, and well caught up behind. Golden



GOLDEN SWAN AT RUAKURA.

Swan's progeny show very satisfactory uniformity of type, and that some of these—even the second generation—have won in the show-ring indicates that in the opinion of judges the type is satisfactory.

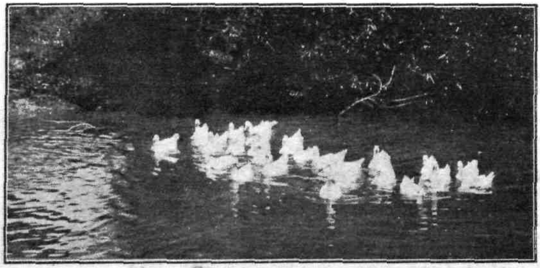
THE CRUCIAL TEST.

In the opinion of the writer the above-given recommendations alone are not sufficient to have warranted the purchase of this bull. Satisfactory as they are, Golden Swan's greatest claim to attention is the record of his daughters. Six have received certificates, and three other daughters entered for test are now having their productions authenticated.

It will be admitted by nearly all testing breeders that a large proportion of the cows of the breed, properly cared for, can produce the minimum required for a certificate. When we get yields of 100 lb. of butter-fat above the standard a higher class of animal is indicated. A production of 240 lb. of fat over her standard, with New Zealand Jersey methods of feeding and twice-a-day milking, stamps a cow for a class yet more select.

There are some twenty-eight C.O.R. Jerseys which have qualified on such a production. This is equal to a mature record of 590 lb. fat, or a two-year-old record of 480·5 lb. fat. These twenty-eight cows represent twenty sires. Sixteen females represent as many different sires. Brighton Twylish is represented by two daughters, K.C.B. and Eminent's Fontaine each by three daughters, and Golden Swan by four daughters.

It is recognized that the certificate-of-record testing is still comparatively new in New Zealand, and that some of the good strains of purebred cattle have not yet had an opportunity of placing on record in number or in quality those yields which will do them justice. The records extant are, however, the only ones on which a judgment could be based. From the viewpoint of high-record daughters both K.C.B. and Eminent's Fontaine would be considered in the same class as Golden Swan. K.C.B. is dead. It is unlikely that Mr. Dermer could be tempted to part with Eminent's Fontaine. It would appear, therefore, that the Ruakura Farm of Instruction has purchased the best prospect available. All who have the interest of the breed at heart trust that Golden Swan's influence at Ruakura will be salutary and long perpetuated.



DUCKS AT MILTON POULTRY-STATION.

GRAVY-EYE, OR MATTERY-EYE, IN POTATOES.

BACTERIAL OUTBREAK IN PUKEKOHE DISTRICT.

R. WATERS, Biology Section.

FOR many years the occurrence of bacterial potato-disease has been reported from various potato-growing districts throughout New Zealand, but as a rule the attacks have not been sufficiently widespread to occasion any great concern. In these comparatively mild forms of attack the disease has frequently not especially attracted the attention of growers, or, if so, it has in many cases been associated by them with the ordinary soft-rotting of tubers, the appearance of which will be familiar to many. Moreover, bacterial disease of potatoes in its early stages, showing as it does little outward sign of the disorganization within the tubers, would often pass unnoticed. In these circumstances seed-potato growers will have frequently left the obviously rotten ones on the land and gathered amongst the good seed a small or large proportion of affected sets. Or, again, the seed may have been harvested before the disease had managed to make such outward manifestation of its presence. Such infested seed has undoubtedly been bought and sold for some years, and the brownish ring appearing when the tubers are cut prior to sowing has been often wrongly attributed to the somewhat similar-looking diseases variously known as "rust," "internal brown-spot," &c.

Considering how little attention is often given to the selection of seed, it is a matter of considerable surprise that certain bacterial troubles have not become widespread. It was apparently thought that the general New Zealand conditions were unfavourable to their spread. This, however, so far as one particular potato-growing district in the vicinity of Pukekohe, near Auckland, is concerned, has been shown to be incorrect. In that district great damage has recently been occasioned by a bacterial disease popularly known as "gravy-eye," or "mattery-eye," agreeing very closely in general characteristics with the American black-rot of potatoes (*Bacillus solanacearum*).

In 1916 the attention of certain Pukekohe potato-seed growers was attracted to damp portions of their land where the plants had wilted and the tubers had been damaged. Such portions, so far as they could judge, however, were discarded. Thus for several years

at least the disease has been distributed in the seed, and has recurred in subsequent crops over an increasing area, but only in small proportions. Not until about the close of the last potato season just concluded did the trouble come to assume the form of a serious epidemic. The season was an exceptionally wet one, and accompanied by considerable heat. The conditions evidently favoured the disease, which promptly exceeded its usually limited bounds and destroyed a number of crops to the extent of from 10 to 75 per cent., according to the wetness of the land, the proportion of diseased tubers in the seed, and the time at which the resultant crops were harvested.

The area affected probably exceeds 300 acres. The cost of raising this area according to local practice would doubtless be not less than £10,000, while the value of its yield, estimated at 2,400 tons, would at recent rates be £28,000.

FEATURES IN PUKEKOHE METHODS AND THEIR BEARING UPON THE DISEASE.

The following preliminary observations and suggestions are made after a personal examination of the affected crops and their surroundings:—

Seed.—Gamekeeper and Northern Star are the main varieties used, and the growers are loath to plant other than locally raised seed, largely for the following reasons: (1.) The strains of these varieties in their possession are uniform and apparently true to name. (2.) In this environment their superiority to heavier-cropping varieties in the matter of "blight" (*Phytophthora infestans*) resistance commends them. (3.) They are vigorous types, and said to be not especially susceptible to frost. (4.) Gamekeeper and Northern Star seed which has been brought into the district has created distrust, owing to the mixed character of the crops it yielded or by reason of its apparent unsuitability to the different surroundings. (5.) Seed of these and, in fact, of other varieties from the South Island is by no means commended by local experience.

Doubtless the experience of growers is weighty evidence in favour of the high esteem in which local seed is held throughout the district. Nevertheless it should certainly be called to mind that in using local seed almost exclusively for many years there is a grave danger of perpetuating and distributing potato troubles and of favouring an epidemic of any disease that once obtains a footing. This has undoubtedly been one of the main contributory factors in the case of the present outbreak.

It was noted, for instance, that the crops grown in various places, but all from the same seed-grower's output, very often yielded a similar proportion of affected plants. In one case a certain grower's sets were found, roughly, to yield 5 to 10 per cent. of affected plants, while in the case of another line of seed the crops in almost every case yielded a very high percentage of disease. Occasionally, however, certain factors would upset these results. Thus early harvesting of the 1917 autumn crop was shown to save considerable infection in a crop the seed of which had elsewhere given very bad results. On the other hand, particularly damp patches were seen to accentuate bacterial disease in crops from seed that elsewhere had yielded only a small percentage of affected tubers.

Concerning seed obtained outside Pukekohe, there are to be seen several examples of lately introduced seed producing in diseased areas crops up to the time of writing free from contamination. In one case, moreover, in which the seed was obtained from Feilding, the crop promised to be perfectly satisfactory in its yield per acre. This instance naturally suggests that local growers might well employ such a crop for seed, or, better still, obtain as far as possible seed of the same strain at Feilding for sowing at least a portion of their land during the coming June.

While on the subject of seed, it must be strongly emphasized that a local seed-grower would follow an exceedingly short-sighted policy if he himself sowed or sold as seed (even at high rates) any tubers known to be affected with bacterial disease. Particularly would this be so if such seed were used in his own district; but none the less would the district's reputation suffer if the seed were sold to outsiders. Potatoes showing the presence of the disease were found bagged up on one or two farms, presumably for seed. Such tubers should be burnt. On the other hand, buyers of seed would be well advised (as a precautionary measure only) to treat all the local seed with suspicion. The earlier-harvested crops in general are reported to be much less diseased than the later ones. Purchasers should always ascertain whether or not the seed under offer was derived from an infected source, and only that from reputedly clean crops should be entertained. Samples properly representing the line offered should also be rigorously examined before purchasing. The tubers should be cut in half and allowed to stand for an hour or so. If by then the characteristic dark ring or dark points develop upon the cut surfaces the line should be avoided.

The planting of whole seed has been suggested in order to make use of the skin, which is the natural means of protection for the interior against bacteria, but it would be better to cut all sets (at least of

Pukekohe seed) at the stem end and ascertain whether or not they are diseased than risk the chance of using whole tubers that may be affected.

Fertilizers.—Generally speaking, Pukekohe growers are liberal in the application of artificial fertilizers, 15 cwt. per acre not infrequently being used, and bonedust being the most favoured form. Potash, at present high in price and almost impossible to obtain, would be of great advantage when it becomes practicable to employ it, as potassic fertilizers appear to reduce the effects of bacterial diseases in potatoes. Proprietary mixtures containing nitrogenous fertilizers should be avoided. In connection with bacterial disease, lime also is often of doubtful value.

Crop Rotations.—The practice in Pukekohe is unique, but in keeping with favourable climatic conditions of the locality. According to the weather, a spring crop is sown often about June or July, and is lifted about October or November. Seed saved from this crop is regarded as highly suitable for the autumn crop, which is often sown the following December or January and gathered in in March or April. The land thereafter may be put down to grass, or may be similarly cropped with potatoes in the succeeding year. By some the growing of onions and a few other crops is also introduced into their rotation.

The frequent cropping of potatoes on the same land is a well-known reason for the perpetuation of disease, and it would be especially inadvisable in cases where the bacterial disease had made its appearance. The custom is to dig the crop and gather the good tubers, leaving the noticeably bad ones on the ground. It is impracticable to recover and burn all affected parts of the plants; thus the land is liable to be a source of danger to subsequent potato crops for two or three years. Under dry, cool conditions it is, of course, possible that potatoes could again immediately be grown on infected land and yield only a small proportion of damaged tubers; but, considering the cost of raising this crop, the risk is too great to take wherever it can possibly be avoided.

Spraying and Dipping.—Bordeaux spraying for fungoid diseases is regularly carried out in the district. Seeing, however, that the bacteria rapidly reach internal parts, both Bordeaux spraying and dipping are of little avail for this particular disease. There is some foundation for thinking that the bacteria gain easy access at those places where insects have laid bare internal tissues. For this reason the inclusion of 1 lb. to 1½ lb. of a reliable brand of arsenate of lead per 50 gallons of Bordeaux mixture would assist in the control of biting-insects, and more particularly of the grub of the potato-moth (*Gelechia operculella*), which was noted in enormous numbers about

bacterially infested plots. The burning of as much of the remains as possible; moulding up so as to cover well the developing tubers; rapid bagging and protected storage, to avoid moth-infestation, also should be continued. This is advisable if only on account of the injury of which this grub is capable, but incidentally for removing one of the suspected causes of the spread of bacteria in growing as well as in harvested potatoes.

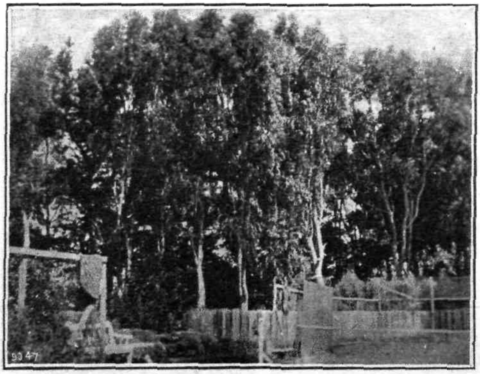
More frequent spraying and re-treatment, according to the demands of wet weather, may be suggested as improvements on the practice occasionally adopted.

Drainage.—Some of the potato plots received in places the drainage of adjacent higher levels, or were themselves naturally or artifically not provided with the means for quickly disposing of surplus water after heavy rains. Here the bad effects of excessive rain had continued for a longer period, and were demonstrated in the diseased condition of the crops. The planting of small but particularly wet patches in a plot might well be omitted while liability exists to the attack and spread of bacterial disease. Not always, however, did disease follow apparently wet conditions, for an excess of water is not in itself sufficient to produce disease. This crop itself, crop-remains, or plants allied to the potato must also be present; moreover, the temperature, and doubtless other physical, chemical, and physiological conditions of which at present we have little or no knowledge must all be sufficiently favourable to the organism at the time when it is ready to attack. Only in these circumstances is infection accomplished; but when the bacteria are present each essential condition is perfect for them, then it is that an epidemic occurs.

The organization and practical co-operation of local growers, buyers, and sellers is required, if only for the purpose of substituting suitable or harmless crop-environments for avoidable bacteria-favouring conditions. This should at least avert the recurrence of epidemics and finally control effectively or perhaps stamp out the disease throughout the district.

Harvesting.—With a little practice a difference can frequently be seen at a glance between bacterially affected tops and those attacked by "blight." The leaves of the former wilt something like the latter, but the stems discolour brown and bend over, remaining for some time moist and supple—unlike "blighted" plants, the haulms of which commonly continue for some time straight, upright, and more or less green. With this in mind, a grower could do really good work by carefully lifting out, bagging, and burning any odd plants he noticed, thus reducing the liability of contaminating healthy ones. A number of diseased patches were noted, suggesting contagion where a diseased

plant had contacted healthy surrounding ones. The bacteria may also be carried in the air from the centres of infection. The consensus of local opinion is that the effects of the attack this year were first observed towards the end of February or the beginning of March. This was supported by the fact that, as far as could be ascertained, the disease was not noticed in crops gathered about that time—the later ones suffering. The spring crops should certainly be watched, despite the popular belief in their comparative immunity; and from a little before the above time onward the autumn crops should be closely observed. If the elimination of odd plants becomes too laborious and fails to arrest the disease, then the lifting of them all, even if a little on the green side, may save a considerable reduction in the total yield. Moisture on the tubers when bagged and dampness in the store, like excessive soil-water, favour mattery-eye. When possible, the sowing of spring and autumn crops at dates enabling the latter to be early harvested may prove to be a good precaution. In some cases this has been done unwittingly with good results.



EUCALYPTUS TERETICORNIS IN SIR J. G. WILSON'S GROUNDS, BULL'S.

The trees are twenty-five years old and 40 feet high.

OUTDOOR CULTURE OF THE GRAPE-VINE IN NEW ZEALAND.

(Concluded.)

S. F. ANDERSON, Vine and Wine Instructor.

THE raising of resistant stocks and the grafting of the vine is a branch of the industry that appears to have considerable attraction, and frequent inquiries are made on the subject by growers. The amateur is warned, however, that the art of plant-propagation is one that requires a good knowledge of plant physiology and many years' practice before success can be attained.

The following extracts from a pamphlet by the late Mr. R. Bragato, prepared by him when in the service of this Department, so fully cover the subject that they are here appended, together with the original illustrations.

PROPAGATION OF AMERICAN VINE-STOCKS.*

I would advise all grape-growers, and those who intend planting outdoor grapes, not to plant out the cuttings direct into the permanent vineyard. Some of the American vines are propagated only with difficulty, and serious loss would result if they are planted out before being rooted in the nursery. To avoid loss of time, labour, expense, and disappointment following a number of misses, it is advisable to prepare a nursery for the purposes of propagating and grafting. This allows of the cuttings and grafts being concentrated in a small area, where they are easier managed and under better control than when spread over a larger tract of land in the widely planted vineyard.

Site and Preparation of Nursery.—The position of the nursery should be near that of the proposed vineyard if possible, and the best piece of land available should be selected. The following are the chief points for consideration in the selection of the site for a nursery: (1) The soil should be deep, rich, loose, and fertile, care being taken to make sure that it is well drained; (2) the aspect should be north-easterly, warm, well sheltered from the cold winds, and free from late frosts in the spring.

The soil of the nursery must be well cultivated before planting; in ordinary good, loose soils it should be trenched to a depth of 18 in. and exposed to the sun and weather, whilst the land should be improved by the addition of well-rotted manures, leaf-mould, sand, and other good rooting-mediums.

* As previously indicated, the special value of the American vines lies in the power they possess of resisting the attacks of phylloxera.

The main object to be kept in view in the preparation of the nursery is to secure a medium, loose, well-drained soil. This assists the cuttings by allowing them to root freely, and at the same time provides a soil sufficiently rich in plant-food to keep the young vine well nourished.

Unfortunately, in many districts it is impossible to make the nursery anywhere except in clay soils. These, on account of their compact nature, retard the free development of the tender new roots, and the cuttings fail to strike, or grow very weakly. Still, with proper preparation, a good nursery may be secured even on clay land. First of all, it must be trenched some months before planting. If the clay is very stiff and tenacious it will be greatly improved by burning it in heaps, afterwards scattering them and working it into the land again. A dressing of slaked lime, at the rate of 3 or 4 tons to the acre, is advisable, and the soil generally improved by the addition of well-rotted manures, sand, &c.

In every case the nursery must be properly and efficiently drained. Ill-drained soils are always cold; the excess of water in the land slowly evaporates into the air. This means that the sun's heat is absorbed in converting the moisture of the soil into vapour, instead of warming the land and assisting the growth of the plants. Hence the necessity in most soils for artificial drainage. This is best done by means of tile drains, but where the tiles cannot be procured drains may be opened up and partially filled in with large lumps of metal, on the top of which small stones should be placed to prevent the soil washing through. Care must, of course, be taken that all drains are laid below the depth to which the land is trenched. The nursery should be laid out in beds.

METHODS OF PROPAGATION.

The ground for the nursery having been selected and properly prepared, the question to be settled is the best method of propagation.

From Seeds.—The simplest and most natural method of propagating the vine is by sowing the seeds obtained from the ripe fruit of the selected variety. Unfortunately, the seedlings thus raised often vary greatly from the parent plant. More especially is this noticeable in the case of hybrids, and consequently the method is useless for the practical grower, although it affords an interesting field for experimentalists, as most of the new varieties are obtained from seeds.

From Cuttings.—The most common method of propagating and multiplying the different varieties of vines is by means of cuttings. To obtain the best results by this system the cuttings should be carefully selected from the healthiest and most vigorous vines, and on no account taken from weak ones nor those affected with disease. The wood should be clean and well ripened, with the buds close together, the portion nearest to the trunk being the best.

As the cuttings are usually planted some time after being selected and removed from the parent plant, it is essential they should be carefully preserved during the period between the taking of the cuttings and planting them out. By doing so the sap and moisture is conserved, and the vitality of the cutting retained. For this purpose a dry spot should be selected, and a pit dug about 18 in. or 2 ft. deep, varying in size according to the number of cuttings to be preserved.

The bottom of the pit should be lightly watered, the cuttings tied up in bundles of fifty, laid lengthwise in the pit, and covered in with dry soil. When required for planting they must be dug up with great care, only removing the quantity required for immediate use. By this method and the exercise of the precautions mentioned the cuttings may be preserved in good condition for several months.

In the case of cuttings coming from a long distance it is advisable to soak them for two days in running water, or water frequently changed, before pitting them.

Most of the American vines, such as the Riparia, Rupestris, &c., are easily propagated from cuttings. The lower buds should be removed with a sharp knife, and the cuttings planted at once. By keeping the soil in a moist condition upwards of 75 per cent. of successful strikings may be obtained.

Length of Cuttings.—The length of cuttings is an important matter. No hard-and-fast rule can be laid down, and it is advisable to vary the length according to the nature and condition of the soil. In loose, friable, dry, or sandy soils it is necessary, in order to provide the cuttings with sufficient moisture, to plant them from 10 in. to 14 in. long. In clayey, stiff, tenacious, or wet soils so much length is not desirable, and 9 in. is quite long enough.

It will be noted in general practice that the shorter cuttings possess more vigour and flourish better than the longer ones.

Time of planting Cuttings.—In most districts of New Zealand it is wise to defer the planting of cuttings until the late spring, when the buds are swelling and bursting, and the ground possesses sufficient warmth for the development of the young roots. If the cuttings are planted earlier than this they are liable to break in a weak and sickly fashion. This is due to the fact that the upper bud, which is above ground, finds itself in a warmer temperature than the lower or inferior bud underground. This results in the upper bud breaking into leaf before the lower bud has burst and begun to send out roots. The consequence is the upper bud bursts and commences to grow, finding its nourishment in the sap of the cutting; when this small supply is exhausted there is no further food available, and the shoot withers and dies.

To avoid this I strongly advise planting in the late spring. If the cuttings in the pit show signs of bursting buds the grower need not become alarmed; all that is necessary is to remove the shoots with a sharp knife before planting.

Planting the Cuttings.—The ground having been trenched and manured as advised in preparation of the nursery, a furrow or drill about 8 in. deep is opened up. This may be done with the spade in small nurseries, or in larger ones by means of an ordinary plough, or, better still, with the double mouldboard plough used for opening up potato-drills. The drills or furrows should not be less than the depth advised, and the rows should be 3 ft. apart.

The cutting is placed against the side of the furrow, one bud being left exposed just above the level of the ground. The cuttings are then earthed over and the soil gently firmed with the foot. Afterwards the bud exposed should be lightly covered with light soil or sand; this

keeps it moist, and protects it from extreme heat and cold. The cuttings should be planted in a vertical position, and about 6 in. apart.

I have noticed in this country the practice of planting cuttings lengthwise or horizontally: this method is strongly condemned by experienced growers, as, although more shoots may be obtained from each cutting by this means, they are much weaker, and the ultimate result is a loss to the grower. One cutting for one future plant should be the grower's aim.

In light well-cultivated soils cuttings may be planted by dibbling instead of opening up drills. In this method a hole is dibbled the length of the cutting; one man is employed in dibbling the holes, while a second plants the cuttings in them and fills in around the cuttings with good top soil. A crowbar or dibble is then inserted into the soil near the cutting in an angular direction, and pressed down until its point reaches near the bottom of the cutting. The crowbar is then raised to an upright position alongside the cutting, thus packing it firmly around with the soil.

The subsequent care of the cuttings is mostly a matter of hoeing, weeding, and stirring the soil. In the event of the land becoming very dry irrigation or watering must be resorted to.

GRAFTING.

Grafting is the operation of removing a bud or scion from one variety and placing it in contact with the wood of another variety, which is to be used as the stock. At the points where the stock and scion meet a growth appears, which is known as the callus. This gradually spreads until it meets and unites. The sap then flows between the stock and the scion, and the grafting is completed. The result of the operation is that the buds, leaves, blossoms, and fruit of the scion are nourished by the sap and roots of another grape; whilst the roots of the stock are developed by the leaves of the scion.

The essential conditions for success in grafting is the complete and even contact of the surface of the scion with that of the stock, and care must be taken to bring the cambium or generative layers of the scion in close touch with those of the stock. The other conditions necessary for a good and rapid union of stock and scion are a right temperature, a certain amount of moisture, and the free access of air. If the temperature is too low the vigour of the stock is impaired, and either failure results or the growth of the scion is weak. On the other hand, if the temperature is too high the scion dries up before the union is completed, whilst sudden changes of temperature are always dangerous. The growth of the uniting tissue is assisted by the presence of fresh air, and if the junction is constantly wet the free access of the air is impeded and the respiration of the new tissue hampered.

We have already remarked that the physiological condition of the grafted vine is abnormal. We have two plants of the same species, it is true, but they differ widely in their habits and characteristics. The one a wild, uncultivated variety from the plains, forests, and mountains of America; the other the result of a thousand years of careful selection, crossing, and cultivation in Europe. These two are, as it were, made one, and they become absolutely dependent on one another for their very existence. It must be obvious to the reader

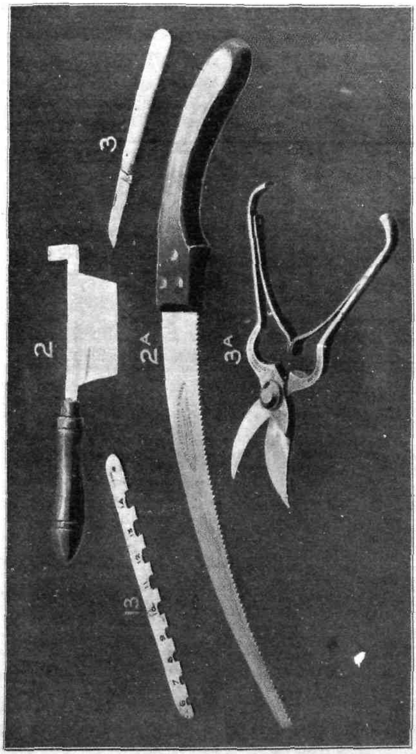


FIG. 31. GRAFTING-TOOLS.

2. Wedge-knife. 2A. Grafting-saw. 3. Grafting-knife. 3A. Secateurs. 13. Gauge for sorting cuttings.

that for this union to become a complete success the two must be, as the French say, *en rapport*, or, as nearly as the English language describes it, they must display a marked affinity for each other.

Affinity may be described as a complex relation between the tissue or protoplasm of the scion and that of the stock. Where the relation is a harmonious one, and the two show a liking for each other, the union is soon complete and both flourish. The roots of the stock develop indifferent to the louse so dreaded by its scion; the scion flourishing vigorously and bearing fruit abundantly, undisturbed by the fact that it is being nourished by a foreigner and an alien. In other cases, where the affinity is weak or absent, neither prosper, and both are subject to disease and even death. Others, again, after displaying an apparent liking for each other for some years, suddenly fail to agree, and the union is dissolved.

The varying degree of affinity between the various stocks and scions can only be determined by years of careful experiments and patient observation, and growers should not plant the American vines and graft them indiscriminately.

TOOLS REQUIRED.

No elaborate tools are necessary for the purpose of grafting. The only ones required are a wedge-knife for splitting the stocks and keeping the wedge open for cleft-grafting on old vines, a pair of secateurs, a saw, and grafting-knives (see Fig. 31).

For binding the grafts the use of raffia is strongly recommended. It can be procured from any seedsman for about 1s. per pound; it is very light, and 1 lb. will do many thousand grafts. It is strong, and at the same time soft and supple, and much better for the purpose than flax or string. It does not rot easily, but in wet localities or very moist soils it should be soaked in a weak solution of bluestone before using. This prevents it rotting before the graft has united. Care, however, should be taken to rinse it in clean water after soaking in the bluestone solution, otherwise the copper might injure the cellular tissue of the callus. Wool is also suitable as a binding-material.

METHODS OF GRAFTING.

The chief consideration in the question of grafting is the choice of method to be adopted. There are numerous methods in existence, but for practical purposes we will limit ourselves to the six principal ones, and select the best of these. Grafting may be performed upon either cuttings or upon rooted vines. The best known methods are the following:—

(1.) *Single or double cleft-grafting*—for old vines.
(2.) *Side-grafting or Cadillac method*—for old vines.
(3.) *English cleft-grafting*—for cuttings or young rooted vines.
(4.) *English whip-tongue grafting*—for cuttings or young rooted vines.
(5.) *Splice-grafting*—for cuttings or young rooted vines.
(6.) *Coiffard method*—for cuttings or young rooted vines.

Single or Double Cleft-grafting.—(On old rooted vines.) Before reading the following description of this method Fig. 32 should be carefully studied, so as to obtain a good idea of the nature of the operation.

First of all the soil should be cleared away from the trunk to a depth of 5 in. or 6 in. The trunk is then cut through horizontally with a saw about 2 in. or 3 in. below the level of the ground. Then with a strong hooked knife or the wedge-knife illustrated cut down in one or two places according to the number of scions the grower desires to work on to the stock. In making the cut, follow the direction of the grain of the wood, and keep the incisions open with wooden wedges or the steel one attached to the wedge-knife.

Scions must be cut in the winter or early spring before the sap begins to flow, and stored in dry sand until the time for grafting arrives. They should be taken from healthy fruit-bearing vines, and always from the lower part of the cane close to the trunk. Two buds should be left on the scion, and it is prepared by shaping the lower extremity with a clean smooth cut in an oblique direction on both sides, leaving the wedge-shaped bottom thicker on the outer face than on the inside.

The scion is then inserted in the incision made in the stock, care being taken to bring the lower bud of the scion as close as possible to the surface of the trunk. In the operation the greatest care must be taken to make sure that the inner bark on the cut faces of the scion is brought in contact with, and exactly meets, the inner bark about the incision of the stock (see Fig. 32). The scion should only be prepared a few moments before it is inserted into the aperture in the stock.

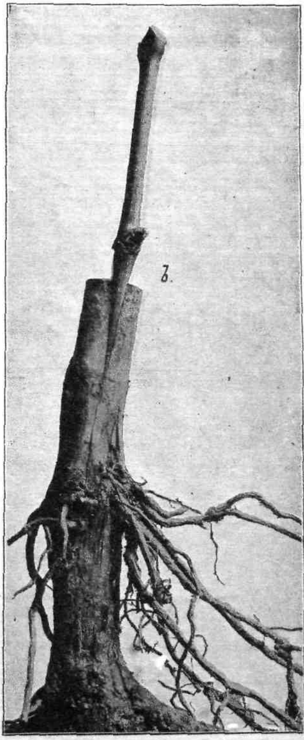


FIG. 32. CLEFT-GRAFTING ON AN OLD VINE.

The best time to carry out this method of grafting is in the late spring, when the sap of the stock is in free circulation and its leaves about 1 in. or 2 in. in diameter. By grafting at this time of the year

the danger of bleeding is minimized. Late in the spring it is a good practice to prune the vines intended to be grafted, and thus permit them to bleed for a week or two before the grafting is effected.

It is also of the utmost importance that the buds of the scion should be dormant. If the scion is in leaf and the stock dormant when grafting the operation will result in failure, by reason of the shoots of the scion being unable to draw nourishment from the stock on which it is grafted.

After the scion has been inserted into the stock the union is bound and covered with grafting-wax or clay. The soil is then replaced around the trunk and left slightly raised. When the buds of the scion have burst and the young shoots are about 5 in. or 6 in. long the graft should be uncovered and the wax and binding removed. Any roots growing from the scion or at the graft must be cut away and all suckers suppressed. As the shoots from the scion increase in length they should be supported by tying to a stake.

Side-grafting, or Cadillac Method.—This method is illustrated in Fig. 33 and differs in treatment from the ordinary cleft-grafting by being made at the side and above ground. It is generally adopted by growers who, while anxious to change the varieties of their vines, wish to obtain a crop or two from the original vines while the scion is developing, the old vine being removed at *a b*.

English Cleft-grafting. — This method is shown in Fig. 34, and to be successful it is necessary that stock and scion should be of the same thickness. Consequently it can only be applied to cuttings or young rooted vines. The scion is prepared as shown at *a*, and when inserted in the cleft care must be taken to bring the inner bark at the sides of the wedge on the scion into contact with that of the cleft. The graft should afterwards be bound firmly with raffia.

Although easily performed, this method is not the most successful one. The reader will notice that the cut surfaces of both the stock and the scion are partly exposed, and this hinders the perfect knitting of the two. On account of these drawbacks I would not advocate its use by growers here.

English Whip-tongue Grafting.—The method I would strongly advise all growers to use for bench grafting in preference to any other is the English whip-tongue grafting. This method may be described unhesitatingly as the standard method of grafting. It is shown in Fig. 35, and is equally adaptable for cuttings or young rooted vines.

It is essential, in order to obtain success in this method of grafting, that the scions and stocks should be of the same size in diameter, none less than ¼ in. through. An experienced operator has no difficulty in sorting them out in varying sizes to fit each other, but the gauge shown in Fig. 31 will assist the beginner in this matter. The reader will note that this gauge is fitted with nine gaps, numbered from 6 to 14. The size of a cutting is found by placing it in these gaps until the one it fits is ascertained. By this means they are sorted out on the bench in heaps, care, of course, being taken to keep the stocks and scions separate. Then No. 6 scions are worked on to No. 6 stocks, and No. 7 on No. 7, and so on. With practice the eye soon becomes trained, and the sorting-gauge may be dispensed with. Both scions and stocks should be

selected from vigorous, full-bearing vines, free from disease. They should always be taken from the base of the canes, and never from the middle or end.

[NOTE.—The canes of the Riparia and other American vines are of almost the same thickness throughout the whole of their length, and

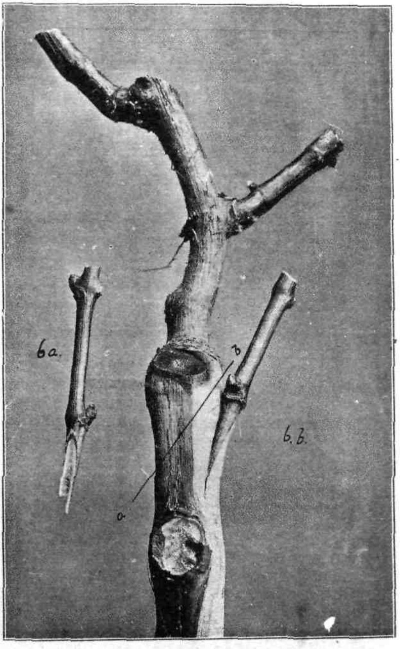


FIG. 33. SIDE-GRAFTING, OR CADILLAC METHOD, ON AN OLD VINE.
6a. Scion ready for fixing. *6b.* Scion inserted in stock.

it is difficult at first to distinguish between cuttings from the base of the cane and those from the middle or ends. This has given dishonest dealers an opening for foisting inferior cuttings upon growers. A simple test to determine which part of the cane the cuttings came from is to carefully examine the pith at the ends. If it is small and surrounded

with a thick ring of wood it may be safely assumed that the cutting came from the base of the cane; if, on the other hand, the pith is thick and the wood only a thin ring, the cutting is from the middle or the top of the cane, and should be rejected for grafting purposes. For, in addition to the difficulty of getting a smooth cut across the pith, there is always the risk of trying to mate cuttings from different parts of the canes. If in grafting the operator works a scion with a large thickness of pith on to a stock with only a small pith, there is an excess of sap from the stock and not sufficient wood on the scion to absorb it, the scion lacks vigour, and is drowned with the excess of sap. Worse still is the result following *upon the attempt to graft a scion* from the base of a cane and with a small pith on to a stock from the tip of a cane with a large pith and small wood. It is obvious that in this case the stock will be unable to supply sufficient sap to nourish the scion, and, through the wood of the stock not being equal to that of the scion, the rising of the sap will be arrested at the graft, and, oozing out, will form a growth which in time may destroy the vine.]

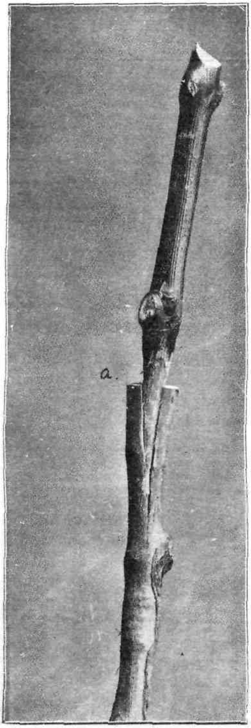


FIG. 34. ENGLISH CLEFT GRAFTING, ON YOUNG ROOTED STOCK.

The operation of whip-tongue grafting is illustrated in Fig. 35. A clean cut is made obliquely in a downward direction on the scion, and in an upward direction on the stock, at the angle shown in the illustration (*a*). This cut should start nearly level with a bud on the opposite side, and its length should be about three times the thickness of the cutting. Then a longitudinal incision is made on both stock and scion about one-third of the way down from the point (*a*) and between the pith and the wood, following the grain of the wood to a depth of about ½ in. As the knife is withdrawn a slight twist is given to open up the incisions (*b*). The tongues thus formed should then be fitted into the clefts firmly, so that the stock and scion meet and fit into each other perfectly (*c*). The graft should now be bound up with

raffia, care being taken to leave a space between the strands to allow of the free circulation of air around the newly made cuts. The binding may, however, be dispensed with where the grafted cuttings are to be calloused, as described below.

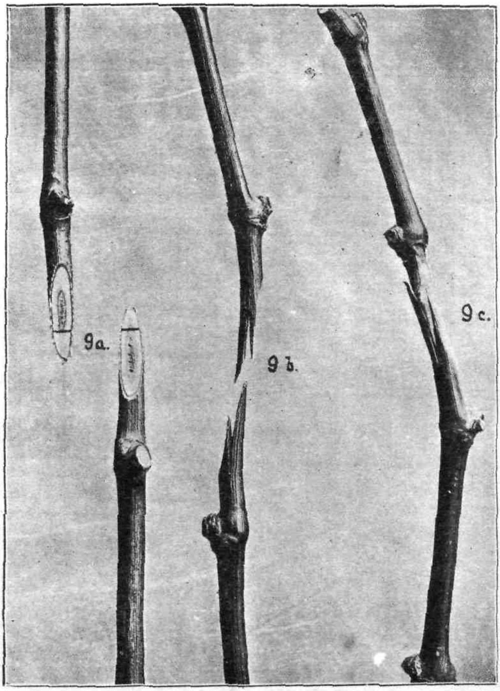


FIG. 35. ENGLISH WHIP-TONGUE GRAFTING.

9*a*. Showing position of longitudinal cuts. 9*b*. Stock and scion ready for fixing. 9*c*. Stock and scion united.

The advantages of this method of grafting are obvious. It may be done indoors at a bench or table on a rainy day or evening. It is pleasant work, and with a little practice is easily learnt; a skilful operator can get through from three to five hundred a day. Women

and girls, having more dexterous fingers than men, are generally the best operators. This method is as easily applied to rooted vines as to cuttings, but in this case care must be taken to lift the vines carefully and gently shake the soil from the roots before bringing them to the grafting-bench.

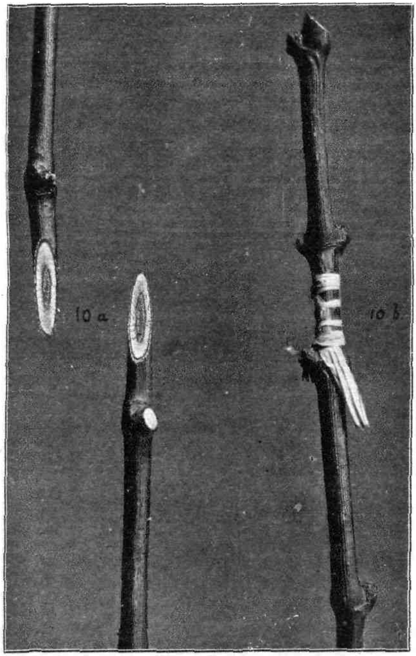


FIG. 36. SPLICE-GRAFTING.

10*a*. Showing preparation of stock and scion. 10*b*. Stock and scion united.

Splice-grafting.—This method differs from the whip-tongue grafting described above, in that the longitudinal cuts which form the tongues and clefts are dispensed with. The plain cut surfaces are brought together and bound (see Fig. 36). The precautions already mentioned under whip-tongue grafting with regard to the selection of stocks and

scions must be carefully followed both in this and the Coiffard method, described below.

Coiffard Method (Fig. 37).—This is a modification of the splice-graft, in which, instead of binding the stocks together, a piece of stiff

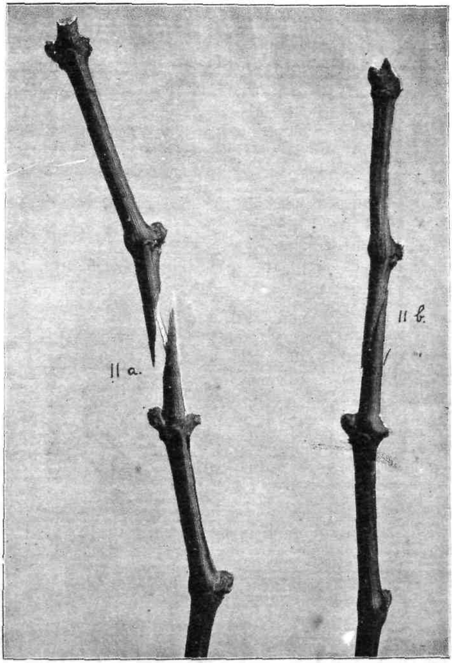


FIG. 37. COIFFARD METHOD OF GRAFTING.

11*a*. Showing wire holding stock and scion. 11*b*. Stock and scion united.

wire about 2½ in. long (*a*) is used to hold the grafted cuttings in position. The wire should be sharpened at both ends to avoid crushing the pith. The wire is inserted for half its length into the centre of the pith of the stock, and the remaining half is pressed through the centre

of the pith of the scion (*b*). The two are then pressed firmly together, and the cut surfaces, which have been prepared as shown for splice-grafting, are brought exactly in contact with each other (*c*). The great advantage of this method is that all necessity for binding is obviated, and a perfect graft is obtained equal to the English whip-tongue graft.

CALLOUSING.

This is an important operation, by means of which the knitting-tissue between the scion and the graft is started before planting out in the nursery. By this practice, now adopted in all wine-growing countries, a much higher percentage of successful strikings is secured to the grower. For the purposes of this operation it is necessary for the grower to be provided with a small forcing house or frame, where the grafted cuttings may be kept at an even temperature.

The grafted cuttings are placed in a small box between layers of moist moss, and the forcing-house kept at a steady temperature of 60° for a month. Towards the end of this period it will be observed that a callus or growth of new uniting-tissue is formed at the points of union between the scion and stock, and the buds burst, throwing delicate shoots. As soon as this callus is formed the cuttings should be subjected to less heat and exposed to the full light. This will harden the callus and cause the leaves to turn green, thus preparing the cuttings for removal to the less equable temperature of the nursery. The operation is not a difficult one to carry out successfully, and the time and trouble expended on it is amply repaid by the increased number of successful grafts at the disposal of the grower.

A frequent cause of failure in callousing grafted cuttings is the presence of mould, which destroys the newly formed knitting-tissue and prevents a successful union. To avoid this the moss used should be thoroughly sterilized before being used by steaming it, or, failing this, by scalding it in boiling water. As a further safeguard against fungoid growths, pieces of wood charcoal should be placed throughout the layers of moistened moss.

Time of Callousing.—Another important factor in securing a high percentage of strikings is the time of performing the operation. It is essential that the soil should be in a warm state when the calloused cuttings are planted out, otherwise the sudden change of temperature from the warm atmosphere of the forcing-house to the cold soil of the nursery would destroy the knitting-tissue and cause many misses. The operation should, therefore, not be performed in winter, but deferred until the spring, about six or seven weeks before planting. Then it will be much easier to keep the forcing-house at an even temperature, and the soil outside will be sufficiently warm to plant out straightway in the nursery after callousing without any fear of a check.

After planting out, it is necessary to cover the ligature with a handful of sand or light soil. This prevents the callus being dried up and destroyed by the wind or sun. On the other hand, clayey or heavy soils should not be used for this purpose, as they prevent the free access of air, hampering the respiration of the new tissue, and, keeping it wet, cause it to rot.

An Economical Method of Callousing.—Those growers who have no forcing house or frames in which to carry out the callousing of the grafted cuttings can easily prepare a substitute in a spare room or barn, provided it is weathertight and well lighted. All that is necessary is a load or two of hot fermenting stable manure and some sand. The manure is spread out on the floor of the room to a depth of about 18 in., and is trodden down firmly all over. It is then covered with clean sand to a depth of about 4 in. The grafted cuttings are stuck upright in the sand, care being taken that they do not penetrate into the stable manure. They are then covered in with sand so as to fill in all the spaces between the cuttings, and at the same time completely cover them.

After forty days it will be found that the callus has formed and the grafts have knitted, the stock will have begun to send out roots, and the buds of the scion burst, emitting young shoots.

As soon as the temperature outside is warm enough to allow of the cuttings being planted out, the sand should be carefully removed and the cuttings lifted for planting in the nursery.

PLANTING THE GRAFTED CUTTINGS.

The nursery having been well prepared, a trench is opened up in the same way as described for cuttings. A few tin cylinders should be procured, about 9 in. long and 3 in. in diameter. Stand them upright in the trench about 6 in. apart, and place the grafts upright in the cylinder. Care must be taken to make sure that the union of the grafts is level with the surface of the land. The cylinder is then filled with sand on the top, and the space around the cylinder with loose soil. The cylinder is then withdrawn and the earth pressed gently around the sand with the foot. By this means the grafted cutting is left surrounded with sand, and in this it roots easily.

RENNET FROM NEW ZEALAND VELLS.

CONSIGNMENTS of rennet manufactured in England from calf-vells collected throughout the Dominion have been received by the New Zealand Rennet Company. A favourable report on the vells generally was made by the manufacturers, the Viking Rennet Company, London, who stated that after exhaustive trials they found the vells had been taken from calves of suitable age, and yielded a fair percentage of rennet ferment. They would impress upon producers or collectors that the vells should not be cleaned too much; the food inside should be lightly squeezed out; also, if the vells are dried by artificial means the temperature of the drying-room should not exceed 100° F. It may be mentioned that a large consignment of the vells despatched to England was lost in a vessel submarined *en route*. Such contingencies afford an argument for the establishment of rennet-manufacture within the Dominion.

TREE-PLANTING FOR FARMERS.

W. H. TAYLOR, *Horticulturist.*

REAFFORESTATION in its larger aspects is beyond the scope of the farmer, but there is much in tree-planting that it is reasonable for him to undertake. The example in more extensive planting set by some large landholders might also be followed with advantage by others in similar circumstances. While good work has been done by many farmers, there appears to be wanting among them generally a due appreciation of the importance of planting trees and of the possibilities afforded in this direction even by a small farm. Cattle appreciate the shade of trees in hot sunshine, and shelter from the wind. The yield of pastures is increased by moderate shelter, crops generally thrive better. The country is beautified by planting trees, and the climate improved. Incidentally, values are increased by judicious planting. A well-sheltered farm is more productive than a similar place fully exposed to the wind.

TREE-PLANTING FOR SMALL HOLDINGS.

Where the area of a holding is small there is natural reluctance to fence off any of it for planting trees. The necessity for double fencing is a serious bar in many cases. This is a matter of ways and means, however, and does not affect the question in the abstract. There can be no doubt that planting would be profitable in the end.

Profitable planting may be made to apply almost anywhere, even to the shelter which is frequently provided around the home garden or buildings. In such positions it is not unusual to plant *Pinus insignis* or *Cupressus macrocarpa*, or both. Neither is suitable; the trees either occupy too much ground or give endless work in trimming, and the Cupressus usually dies after a few years if close-cropped. In the positions mentioned an outer belt of Lombardy poplars affords quick shelter. Cuttings only are necessary, and these may be put in as close as 2 ft. apart. The poplars should be regarded as temporary shelter, while permanent trees of slower growth are coming on, and might be wholly or in part cut out later on. The trunks of poplars split up freely, and make good droppers for fences, while the rest of the tree and its branches make useful firewood.

The free growth of poplar-cuttings is largely affected by the manner in which the cuttings are put in, and as a large number are annually planted it may be well to point out what is necessary to ensure

success. The length of the cuttings is not so much a factor deciding success or failure as is the fixing of them in the ground without injuring the bark. When the cuttings are driven in with a mallet the bark near the bottom is peeled off, the peeled portion dies, and roots must come from higher up. Roots are more slowly made than would have been the case had the bark not been peeled off, the dead wood at the foot of the cutting resulting from the peeling being detrimental and retarding growth. It is not surprising that in such cases cuttings fail unless very short ones are put in. Cuttings may be with advantage up to 5 ft. in length, provided they are planted deeply and firmly, and are not injured in planting. If tall cuttings are used, they should be about 18 in. in the ground. A crowbar should be used to make the holes. The base of the cutting should rest firmly on the bottom of the hole. Tamp the soil tightly around the cutting, but leave the surface loose.

Although the poplar is here mentioned as a temporary plant, it is not suggested that it is not suitable for permanent planting, but only that better trees are available for the particular purpose referred to.

UTILIZING PADDOCK-CORNERS.

The corners of paddocks under the plough are seldom used for the crop. They are frequently planted, but usually with only a tree or two. If the areas usually enclosed for trees were increased somewhat, useful work could be done. A corner enclosed by running a fence across at a distance of 30 ft. along each of the two fences would provide space for planting twenty-eight or thirty trees averaging 4 ft. apart, and 3 ft. from each fence. Close planting assists growth by providing mutual shelter, and also causes the trees to grow upright The inside trees go up straight to light, while shelter tends to keep the outer trees straight. If the position be very windy the close planting offers chances of successful growth that would be absent with single planting.

The outer row of trees might well be one of the wattles, either black wattle (*Acacia decurrens*) or blackwood (*Acacia melanoxylon*), and the remainder a eucalypt species. For much valuable information regarding species of eucalypts suitable for various conditions in New Zealand readers are referred to the articles by Rev. J. H. Simmonds published in recent issues of the *Journal*.*

The species of wattles mentioned do not sucker, which would be a serious nuisance in the position now being dealt with. The silver wattle suckers very badly. At any stage of growth wattle makes good firewood; so also does the false acacia (*Robinia pseudoacacia*). The Robinia also makes very durable and strong fence-posts, while

* April, 1916, and January, 1917.

the smaller wood is useful as handles for farm implements and for swingletrees. Both these trees flourish on very poor soil, and comparatively worthless knolls planted with them would in a few years become valuable. This kind of planting will be dealt with later.

Reverting to paddock-corners, it may be desired to plant gums only, and this can be done quite successfully. In such case, as these trees naturally become bare at the bottom after a few years, cutting down some at intervals would perpetuate low shelter through second crops on the stumps. The number of trees should be reduced to half when they attain useful size.

A number of pines are also suitable for this kind of planting. The following are useful varieties :—

For poor and dry soil—*Pinus Strobus, P. ponderosa, P. rigida, P. contorta, P. halepensis, P. excelsa, P. insignis (radiata)* ; for moist soil—*P. muricata, P. austriaca, P. Laricio, P. ponderosa, P. insignis (radiata)*. The latter tree should not be planted where frosts are most severe.

PLANTING ON HEDGE-LINES.

Hedges alone make good shelter so far as breaking the wind is concerned, and if suitable trees are planted at intervals in the hedge they provide shade and do not take up space. Such trees form one of the finest features on English farms, and provide firewood by being periodically pollarded (headed down).

The preparation necessary for planting varies with circumstances. Where water lies long on the surface it is usual to dig a ditch. It would in nearly all cases be better to adopt the haw-haw method—that is, a ditch on both sides of a hedge. When this is done the top soil should be thrown up in the centre, thus increasing the depth of good soil for the trees to root in, giving a higher degree of aeration, and accelerating growth. The subsoil should be scattered broadcast over the paddock, instead of banking it up along the side of the ditch, where it prevents the water on the paddock from draining freely into the ditch. The developing trees would, of course, send their roots down into the wetter soil. Ploughing will usually be resorted to for breaking up the soil ; with the haw-haw method it need be only very shallow, just sufficiently deep to bury the vegetation, as the added soil will provide planting-room. Whatever means may be adopted for preparing the soil, care should be taken to preserve the original surface. Trees do not thrive if the subsoil is placed on top.

Trees suitable for planting in hedgerows are mostly round-headed, providing shade without occupying ground-space. The following are recommended : *Betula alba* (silver birch) ; *Fagus sylvatica* (English beech) ; *Fraxinus excelsior* (English ash) ; *Juglans regia* (walnut) ; *Platanus occidentalis* (American plane) ; *P. orientalis*

(Oriental plane); *Populus Bolleana* (silver poplar—does not sucker); Lombardy poplar; *Populus nigra* (black poplar); British oak; English elm.

GENERAL RESULTS.

It may probably be said that the planting above suggested would not provide a great amount of shelter. I know, however, that it would be quite useless to propose more extensive planting on small farms. And if these suggestions were adopted—namely, a good hedge planted on the boundary of a paddock, with trees at intervals of, say, 40 ft., or a little more, with the corners broadened—very fair shelter would be provided. If the corners of two contiguous paddocks were each planted the group would be doubled in size and would contain upwards of seventy trees.

PLANTING FOR MEDIUM-SIZED FARMS.

Farms ranging in size from 100 to 500 acres are plentiful. These afford opportunities for tree-planting which, if taken advantage of by a majority of owners, would in the course of years effect a magical change in the landscape of the Dominion and add materially to its wealth.

Proposals for planting must necessarily take into consideration many varying circumstances. On level country planting will naturally take the form of plantations in straight lines, because the economical working of such land demands rectangular partition. Similarly, the desire for straight fences causes hilly and undulating country to be divided off wherever it is possible. But the necessity for, or advisability of, keeping such areas clear of trees does not always apply, as much of the land would not admit of ploughing, or at least not in straight furrows as part of one operation.

Plantations intended for breakwinds should as far as possible be in continuous lines; any gaps that may be left will, of course, let the wind through. In many cases rich land would be included in the plantation, and it is reasonable to expect rapid growth on such land, which would thus compensate for its loss from cultivation. Isolated groups of trees, whether on hills, knolls, or flat land, while mainly providing local shade and shelter, would necessarily also affect the climate generally, as they, too, break the force of the winds, the benefit derived being in accordance with the extent of the plantations. It is suggested that on properties where there is a proportion of hilly land tree-planting should be mainly confined to such parts. Whereas level land would in most instances produce quickest growth, the hills could best be spared for tree-planting. From a scenic point of view also hill planting is the more effective, having the apparent effect of heightening the hills and deepening the valleys.

CLASSES OF PLANTATIONS.—EUCALYPTS.

The subject of plantations is a very large one, but can be only briefly treated here. Plantations may be roughly divided into four classes—namely, (1) for combined ornament and shelter; (2) for the production of timber; (3) for the production of timber and ornamentation combined; (4) for the production of timber where an outer line of shelter-trees is necessary. The first class of plantation will not be dealt with in this article. In regard to the second class, the eucalypts should, because of their rapid growth and other good qualities, be regarded as the most valuable all-round timber-producing trees to plant for New Zealand conditions. As previously indicated, the articles contributed to the *Journal* by the Rev. J. H. Simmonds have done much to remove the planting of eucalypts from the field of experiment.

A close-set plantation of gum-trees forms at all times an effective breakwind. After a number of years the lower part of the trunks become bare, letting wind through. This condition, as before mentioned, can be remedied by falling the outer lines of trees, which would by then have attained a size that would yield useful fencing-material and firewood. The butts of the trees break into new bushy growth.

PINES.

Pines are very appropriate for planting on hills. In such places growth may at first be slow, but becomes more rapid when the trees begin to shelter each other. It is on hills that pines are long-lived, and some species are liable to die at any time on swampy soil. Plantations of pines on low hilltops form splendid shelter for sheep and cattle.

Too much stress cannot be laid on the importance of extensively planting in suitable locations *Pinus radiata (insignis)*. This is for New Zealand conditions the most valuable of the pines. It is the most rapid growing of all, and will succeed anywhere except in swampy land and where frosts are most severe. Poor dry hillsides are the best places for this tree. Any one having a knoll of poor soil that has little value for any other purpose would be well advised to plant it with *Pinus radiata*. The timber of this tree is very suitable for fruit-cases, and has a great prospective value for butter-box making and many other purposes. From about twenty years the trees should be large enough for box-making, and a large quantity of firewood is supplied by the parts not suitable for milling.

Pine-trees, in common with most others, tend to become bare at the bottom after a number of years. When this state prevails, wind gains access through the plantation and causes a cutting draught. It is not an invariable habit of pines to become bare beneath; some

have a more or less pyramidal habit of growth, while others are round-headed. Poor soil in exposed positions dwarfs the outer line of trees, which are most exposed. In such cases those of pyramidal habit keep their side branches for a very long time, and others that are round-headed, failing to attain any considerable height, remain in a form well adapted to sheltering the inside trees. I am aware of trees of *Pinus halepensis* and *Pinus Pinea* that were planted about fifty years ago on the outskirt of a plantation, and that are now of varying heights from 12 ft. to 20 ft., and clad with branches to the ground.

PLANTING-DISTANCES.—PURE OR MIXED PLANTATIONS, ETC.

The most suitable distances for planting trees in farm plantations range from 4 ft. to 8 ft. apart, according to soil, situation, varieties, &c. The general rule is to plant close on the poorer soils and elevated positions, and further apart on better ground. Six feet apart should be a minimum distance for *Pinus insignis*, eucalypts, and other free-growing trees. Planting 4 ft. apart would require 2,722 trees to the acre, and if these were thinned to 8 ft. apart 680 would remain. Planted at 6 ft. apart there would be 1,210 trees per acre, and if thinned to 12 ft. apart 302 would remain.

As a rule it is best to put out pure plantations. If species are mixed, some are likely to outgrow others that are more valuable, a condition rendered the more probable by the system of close planting proposed. It is, however, recognized that in many cases it is not practicable to plant the same species throughout the whole length of an extensive plantation. Soil and the condition of moisture may vary enormously, and trees should be planted in accordance with such local conditions. This, however, does not afford reasons for mixing the trees, which may be planted in blocks to suit the conditions.

In very exposed places it may be necessary to provide a close shelter around the plantation, or at least on the most exposed side. In such cases the outer belt should be considered quite apart from the plantation itself, inasmuch as the side branches should be left on, although it may be that the same species of tree will answer both purposes.

Some trees that are suitable for timber-production require shelter when young. When such shelter is required the permanent trees should be planted at proper distances and temporary trees planted between them. In the case of pines it may not be actually necessary to avoid mixing the varieties, yet it would be best to plant each in pure blocks. There would then be no danger of any being overgrown by a stronger neighbour, and a better knowledge of comparative values would be obtained.

RIVER-BANK PLANTING.

Planting along river-banks is so well understood as not to call for much attention here. It may be suggested that, while the weeping-willow (*Salix babylonica*) is the best of riverside trees, the scenic effect is enhanced by introducing at irregular intervals trees of a different habit of growth, such as the Lombardy poplar. The alder (*Alnus glutinosa*) thrives in very wet places, and, being a tree of distinct and handsome appearance, is excellent for planting in places where creeks widen out and form miniature swamps. In suitable wet places and along the banks of rivers the osier willow (*Salix viminalis*) should be planted. In future years there will doubtless be increased uses for the osiers, particularly when supplejacks become unavailable, as they must in time. The golden willow (*Salix vitellina*) also thrives in wet places. The chief beauty of this tree is observed in winter. When the foliage has fallen the golden-coloured bark is a distinct feature in the landscape. [NOTE.—The bark loses its golden hue after several years. To preserve that feature it is necessary to head the trees down every second or third year. The new growth assumes the bright-golden colour.] The sallow or goat-willow is a valuable, quick-growing, ornamental breakwind tree that succeeds in any moderately good soil.

TREE-PLANTING ON LARGE ESTATES.

Where comparatively large areas can be devoted to tree-planting proportional cost is in most cases lessened. The extra fencing required to enclose a chain-wide plantation is only the same as for a plantation half a chain wide. The larger operation also brings the plough into greater use. Seeding can be more largely applied, partly because in large areas a few misses will not be of much consequence. Plantations may well be 1 chain wide, at least on the boundaries. Hills where the soil is very poor, and which consequently afford very meagre grazing, would eventually be more profitably employed growing timber-trees than in supporting a few sheep, besides which there would be the attendant benefits previously indicated.

It is not intended on this occasion to go further into the matter of large-scale planting.

METHODS OF PLANTING TREES.

The mode of planting trees should vary according to the state or formation of the roots. The roots may be in ball form—that is, wrenching in the nursery may have severed all the straggling roots and caused the formation of a ball of fibrous roots. Such trees should be planted in the centre of the hole or trench. Tread the soil firmly about the ball of roots, but leave the surface soil loose, and see that it

is kept loose; if beaten down by rain, loosen it as soon as possible. Deciduous trees are usually furnished with stiff roots radiating from the stem more or less regularly all round. These should be planted in the same way as balled trees, even though the roots be naked, as most probably they will be.

If the roots are naked and loose (of a pliable character) the tree should be placed against an upright wall of solid soil—that is, against one side of the hole instead of in the centre. Dig the soil up to the roots and tread firm, leaving the surface loose as in other cases. This method of planting prevents wind-waving, which causes losses when the trees are surrounded by loose soil. It is illustrated in the late Mr. Matthews's book, "Tree-culture in New Zealand." Though somewhat sceptical about the plan, I tried it and found it excellent.

Yet another class of root to deal with is that of plants grown in pots, which is frequent in the case of wattles. The danger in this case is that moisture may not penetrate the hard ball. Endeavour should be made to loose the ball so that soil may key into it; otherwise, and in any case, the soil should be made very firm about the ball. The soil immediately surrounding the ball must be quite as firm as the latter, or else water will sink down through the looser soil and leave the ball of roots dry, when the young tree would be likely to perish.

The time to plant should be ruled by local conditions. Broadly stated, autumn (about the month of May) planting is best for dry places, and spring for wet localities. In some places, such as those which experience mild winters, planting may be done at any time after the commencement of the autumn rains until well into the spring. In these circumstances autumn is decidedly the best time, the gain being practically a season's growth as against spring planting. Autumn planting, however, is decidedly risky where the soil is very wet in winter and cold in early spring. Some years' experience on rich somewhat low-lying land in the Manawatu showed that September and October planting met with most success. Of course, on the higher land in the same locality trees planted so late would not survive.

TREATMENT OF TREES RECEIVED FROM A NURSERY.

Many losses occur which might be avoided by rational treatment. Young trees sent from nurseries naturally and inevitably suffer some check. The trees are lifted without much soil—often none at all—and frequently remain packed for a considerable time. During this time there is no reciprocal action between root and branch, consequently the tops become more or less empty of sap. In the case

of young trees with bare roots there is a struggle for existence, and it is not surprising if many die that are at once planted out in exposed positions. Immediately on receipt the trees should be unpacked and heeled into a plot of sweet friable land, in a fairly sheltered position. The mode of heeling is as follows: First dig about two spits across the plot. Then smooth the face of the last spit so as to leave it at an angle of about 45°. Lay a row of young trees with their roots against this face; then dig the next spit of soil up over the roots. Tread this down moderately firm; then dig the next spit and leave it loose. This will leave the young trees in a sloping position, and they should soon make new roots. Planting out may be done at any time when conditions are propitious after new roots are formed. Intending planters should always order their trees to allow time to do this, allowing six or eight weeks at least. Many wholesale losses would be avoided if this were done. Trees that do not die in the heeling stage are safe afterwards.

SOWING OR PLANTING WATTLE AND EUCALYPT PLANTATIONS.

The amount of preparation the land requires for sowing depends entirely on its character, as also does the manner of seeding. On flats and other places where the soil is good and rainfall liberal, weeds and the natural growth of grass have to be counted with. In such places sowing must be in lines for cultivation purposes, or on land not suitable for ploughing the seed will have to be put in by hand at definite or convenient distances between clumps. Poor-quality land or land where the rainfall is light, can be sown by the broadcast method. In this way large plantations of gum-trees have been established in the Hawke's Bay District. The land was ploughed and harrowed, and the seed scattered and lightly harrowed in. The young plants were thinned where necessary. Naturally there will be some gaps, but in a large area this is of little consequence. The cost of the work is trifling compared with planting young trees. When seeding is possible that method of establishing plantations should be adopted, not only because it is the less expensive method, but more particularly because seedlings that are not disturbed will often succeed in places where it is difficult to establish a transplanted tree. The tap-root of a seedling makes its way down through the soil, finding moisture not to be obtained by surface roots. The tap-root also anchors the plant; wind may blow it over, but the young plant bends like a bow and springs back again.

The time for sowing should be decided by local conditions. Where frost is severe it is best left till spring. Early in October would be a suitable time generally: the worst frosts would have then

occurred, and the soil would be becoming warm. Where, also, weeds are plentiful sowing should be in spring, because if the soil became weedy during the winter or early spring it would be impossible to weed except by hand or by ploughing. Seed sown in spring is put into clean ground; weeds that come up after that can be hoed out. In dry places other than those affected by severe frosts, sowing should be in autumn, as soon as possible after the first autumn rain has fallen.

Wattle-trees are difficult to transplant unless specially prepared or raised in flower-pots, and all large plantings should be by seed. The seed should be soaked in hot water for ten or twelve hours. Put the seed in a convenient vessel and pour on it sufficient boiling water to cover it; then place it on the coolest part of the kitchen-range, and let it remain there for the time stated. Care should be taken not to let the seed dry again before sowing. The seed may be mixed with damp sand or mould, or placed in a damp sack. Sowing should be done as soon as possible after the soaking. One pound of wattle-seed contains upwards of twenty thousand seeds, and is sufficient for an acre of ground.

Most of the eucalypts transplant fairly well if the plants are not too large. Some species are more impatient of transplanting than others, and need special treatment.

My opinion is that plants raised in boxes transplant better than those raised in the open ground, because the roots are not so much broken. But this advantage is lost if the seed is put in too early, as the roots will mat if the plants grow too large. November is early enough to sow. A sheltered and not too sunny position in the open air is best for the seed-boxes. In the autumn or early spring the plants should be taken from the boxes. The best way is to break off one end of the box and slip the contents out; the plants can then be separated without injuring the roots. The young plants may be heeled in a pot of free soil, or they may be mossed up, which is by far the best plan.

Some growers heel the mossed plants in the ground, but an infinitely better plan is to put them in boxes. The method is to use boxes about 3 in. deep. As each plant is mossed it is placed upright in a box. The plants are jammed as closely together as possible, which prevents the moss drying. New roots are soon made, and scarcely a plant should be lost. This method renders easy the transplanting of the most difficult species. Another great advantage is that the boxes are very light, and can be carried to the planting-ground without disturbing the plants. The plants will keep quite safely in the boxes for a year or more.

The proper way to moss is to take a small handful of fresh sphagnum in the open hand, lay the roots of a plant on it, close the hand tightly so as to cover the roots, and bind up firmly with a strip of flax.

The varying conditions in which trees may be planted or seeds sown will have to be met by varying the methods of preparation of the soil. In nearly all cases, however, preparation should begin long before planting or sowing time. In some cases this will be necessary for the breaking-up of the soil, in others for cleaning it. Whenever the soil is deeply broken it should be allowed time to settle. Soil that lies too loose dries out too quickly, and young trees suffer, partly because of the drying of the soil and also because the young roots do not find contact with the soil-particles in the way they should. Soil should be firm below seeds, partly to prevent them sinking too deep and partly because the seedlings perish unless the young roots can find moisture the moment they want it. The moisture must be near the surface, as the roots act only in unison with the foliage, which cannot survive if the roots have to struggle through too much soil. Means should always be found to firm the soil, and the deeper the soil is worked the more necessary this will be. Rainfall will do most of the settling if given time. Where convenient the surface can be dealt with by rolling. When planting or sowing hillsides by hand-labour the operator's feet should be used to tread the soil firm.

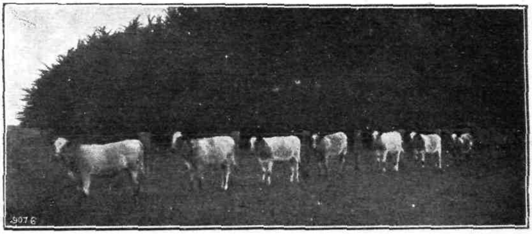
CONCLUSION.

The position as regards tree-planting by farmers may be thus briefly stated. Planting on small farms will if generally carried out have a great effect in beautifying the country and in affording a certain amount of shelter. The owners will derive material benefit from increased shelter, and ultimately some returns for useful wood. Larger farms planted with deeper belts and plantations will provide timber as well as firewood, and a greater degree of shelter. Large estates can be made to exercise considerable influence in the ultimate timber-supply, and they should assume the major responsibility for sheltering the country.

Trees for Farmers.—With a view to encouraging farmers to plant trees for shelter, forest plantations, post timber, firewood, and other purposes on their farms, the Forestry Branch of the Land Department is now prepared to supply suitable trees to farmers who wish to improve their farms in the manner referred to. In the North Island applications for trees should be made to the Superintending Nurseryman at Whakarewarewa, and in the South Island to the Superintending Nurseryman at Tapanui, who will supply price-lists and other particulars.

THE RUAKURA MILKING-SHORTHORN HERD.

EVIDENCE of the success which is attending the efforts made to build up the milking-Shorthorn herd at the Ruakura Farm of Instruction to a high level of excellence is afforded by the awards gained in the show-ring this year. At the Waikato show, held at Hamilton, in the class for yearling Shorthorn heifers Ruakura scored 1st, 2nd, and 3rd places, against keen competition. In the class consisting of a group of a bull and three females the Ruakura stock gained first place. At the Cambridge show yearling milking-Shorthorn heifers from Ruakura, in a class of eighteen competitors, won the 1st, 2nd, and 3rd prizes.



PRIZETAKER YEARLING MILKING-SHORTHORN HEIFERS AT RUAKURA.

The first prize for the best pedigree milking-Shorthorn cow was won by a member of the herd against thirteen other competitors, several of which were purebred Darbalara cows. The same cow was also winner of the champion certificate. It may be added that the first silver cup presented for the best pedigree milking-Shorthorn cow registered in the herd-book of the Waikato Dairy Shorthorn Association was won by Ruakura.

The accompanying photo shows a group of yearling heifers at Ruakura, prizetakers at the above-mentioned Waikato shows. They are all by imported Darbalara bulls.

With reference to the article, "Estuarial Lands of the North Island," published in the April *Journal*, a Hawke's Bay correspondent writes averring that Napier owes its reclamation suburb to Mr. George Nelson, who, he adds, is also the originator of Napier's future inner harbour.

THE NEED OF SEED-TESTING.

SOME CASES IN POINT.

E. BRUCE LEVY, Biology Section.

THE advisability of knowing the purity and germination capacity of the seed we sow has again and again been demonstrated by commercial samples of seed that have been received into and analysed in this Section's laboratory. While this fact has been impressed upon the farming community on many occasions, the matter is one of such vital importance that too much stress cannot be laid upon the need of careful selection of the seed the farmer intends to sow. In these times of expensive seeds the temptation to buy lines of inferior grade is certainly great. The buying, however, of such seed is generally an expensive proposition in the long-run, unless one is skilled enough to detect whether cheapness is due to defective seed or to an error in judgment on the part of the seed-vendor. It must be borne in mind that of late years the seed trade has developed into a fine art, and, as far as the farmer is concerned, very few real "bargains" are to be had, and any line of seed offered by a seed-vendor below the ruling market rates should be looked upon as suspicious.

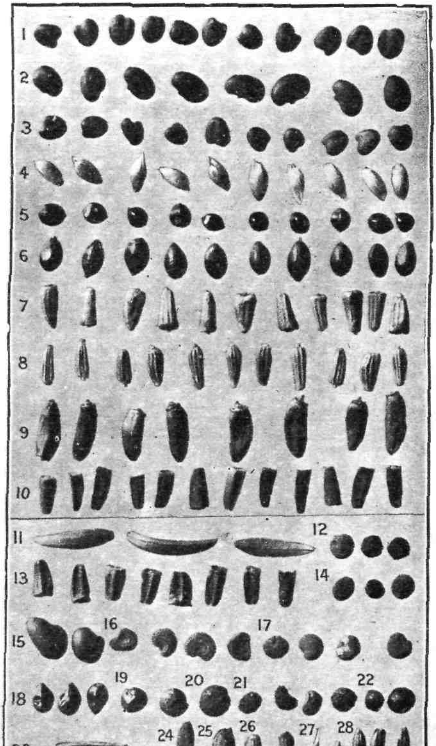
With the buying of high-priced lines, however, the danger is far from being eliminated—it is only reduced. To know the real worth of a line it is absolutely essential to ascertain the germination and purity of that line. Unless this has been done it is extremely risky even for the most experienced person to state that "this line is good" or "that line is bad." Nor is the necessity of a test confined to any particular seed. In general the smaller seeds require the greatest care in selecting, but this cannot be presumed upon. Recently, for instance, a line of white mustard was analysed and was found to contain Californian thistle (large, mature seeds) at the rate of 35 seeds
purposes ound. White mustard had been looked upon in this Laboratory
ment is n of the most unsuspected of seeds. Rye-grass and cocksfoot
to improve
Island appli en found to contain Californian thistle, although the occur-
Nurseryman are. Imported alsike and imported timothy should always
Superintending upon as suspicious, both for containing ox-eye daisy and
and other part thistle. I have recently analysed a sample of timothy
...oo seeds of ragwort per pound.

White clover should always be analysed for dodder-content and for adulteration. A sample of white clover analysed contained 25 per cent. of extraneous seeds, including dodder (*Cuscuta trifolii*) at the rate of 2,700 seeds per pound. Other lines have contained upwards of 70 per cent. of extraneous seeds, which cases were purely a matter of wilful adulteration—clustered clover (*Trifolium glomeratum*) and suckling-clover (*Trifolium minus*) being the adulterants used. Instances of substitution have also been recorded. English trefoil has been sold as lucerne; *Poa nemoralis* has been sold for *Poa trivialis*; *Lotus angustissimus* for *Lotus major*.

The following is an analysis of a clover line received into the Laboratory from a prospective buyer: White clover, 40 per cent.; red clover, 22 per cent.; weeds, &c., 38 per cent. Among the weed-seeds present were included dodder at the rate of 2,000 seeds per pound, and ox-eye daisy at the rate of 40 seeds per pound. Such samples as the above obviously should be condemned at a single glance, but there are cases when the detection of dangerous impurities is exceedingly difficult to the naked eye, and it is such samples that make an analysis imperative. A red-clover sample analysed recently (a very fair sample to look at) contained dodder at the rate of 2,000 seeds per pound.

The following line of alsike, also, is a good instance of a dangerous line clothed with a fair appearance. The sample contained 2 per cent. of extraneous seeds, in which were included ox-eye daisy and Californian thistle at the rate respectively of 240 and 48 seeds per pound. Altogether thirty different kinds of extraneous seeds were noted. These are herein illustrated and tabulated, the photo having been taken of seeds actually selected from the sample. This line serves to demonstrate how land could soon become infested with weeds to the detriment of successful farm operations. Failure must follow the sowing of poor seeds, and the present is not a time for failures.

The foregoing notes have been written as a plea for greater consideration towards the purity of the seeds we sow. Nevertheless, because a few lines of any one seed have been found contaminated with dangerous impurities the total elimination of that seed from our sowings should not be entertained for a moment. Alsike, perhaps, has the strongest case on this point. The consumption of this seed of late years is decreasing, not because the plant has been proved to be inferior, but because alsike-seed is so liable to contain Californian thistle. If a plant has proved its worth as a fodder in any one locality, then to discontinue sowing the seed of that plant for reasons



IMPURITIES IN SAMPLE OF ALSIKE.

Magnified six diameters. See key on opposite page.

stated above is surely a wrong policy, especially when the conveniences for determining the nature of a line have been provided free to the farming community.

KEY TO ALSIKE-SAMPLE IMPURITIES SHOWN IN PHOTOGRAPH.

1, Alsike (*Trifolium hybridum*); 2, English trefoil (*Medicago lupulina*); 3, White clover (*Trifolium repens*); 4, Timothy (*Phleum pratense*); 5, Sorrel (*Rumex acetosella*); 6, Selfheal (*Prunella vulgaris*); 7, Field-chamomile (*Anthemis arvensis*); 8, Ox-eye daisy (*Chrysanthemum leucanthemum*); 9, Californian thistle (*Cnicus arvensis*); 10, Austrian chamomile (*Anthemis austriaca*); 11, Nipplewort (*Lapsana communis*); 12, Chickweed (*Stellaria media*); 13, Mayweed (*Matricaria inodora*); 14, Stitchwort (*Stellaria graminea*); 15, Red clover (*Trifolium pratense*); 16, Bladder-campion (*Silene inflata*); 17, Night-flowering catchfly (*Silene noctiflora*); 18, Forget-me-not (*Myosotis arvensis*); 19, Fat-hen (*Chenopodium album*); 20, Orache (*Atriplex* sp.); 21, Hedge-bedstraw (*Galium Mollugo*); 22, Spurrey (*Spergula arvensis*); 23, Perennial rye-grass (*Lolium perenne*); 24, Crested dogstail (*Cynosurus cristatus*); 25, Small-flowered cranesbill (*Geranium pusillum*); 26, Red tarweed (*Odontites rubra*); 27, Fiorin (*Agrostis* sp.); 28, *Poa pratensis*; 29, Rib-grass (*Plantago lanceolata*); 30, Greater plantain (*Plantago major*); 31, Curled dock (*Rumex crispus*); 32, Alsike (shrivelled seeds).

SCOURING IN CALVES.

THE following useful notes were written by the late J. G. Clayton, M.R.C.V.S., when Veterinarian in this Department, and have not been published previously:—

In young calves the condition of scouring is generally due to indigestion, and is in many cases the result of nature's attempt to relieve the stomach and bowels of irritating contents. The trouble may be due to too long hours between feeding. Young calves up to ten days or a fortnight should be fed at least four times a day, then up to six weeks at least thrice daily. The longer the times between meals the hungrier the animal gets, and it will overload the stomach if not watched. The consequence is that the stomach-juices are not sufficient to act on the milk, and some of this is carried into the bowels without being properly digested and perpar d for absorption. Here it acts as an irritant, and nature endeavours to remove it by extra secretion of the mucous glands—hence arises the condition known as "scours."

Another cause of scours is due to micro-organisms. This is seen where calves are fed with dirty buckets, and often where the receptacle for the milk is filthy. There are few better materials than milk as a medium for growing microbes. It would not matter if the lactic-acid organism only was present, as the latter is practically harmless.

Unfortunately, there are many deleterious organisms that will grow in, and cause souring of, the milk. If milk containing these is given to the calf they increase enormously in the alimentary tract, causing scouring and death in a short time. Hot weather favours their production, so it is not uncommon to have great mortality during a warm spell.

As regards treatment, the first object is to remove the irritant matter from the stomach and bowels, and for this purpose 1 oz. to 2 oz. of castor-oil may be given according to age of calf. If the calves have been having skim-milk, whole milk should be given and the ration reduced by one-half in quantity. About a tablespoonful of lime-water may be given with the milk at each meal. This is the clear water on the top when quicklime is slaked. Do not give laudanum or astringents at the outset; these merely bind up the bowels and retain the trouble. If the calf is very dull, it is better to give it a teacupful of beer. Should the scour be exceptionally evil-smelling, formalin may be added to the milk in the proportion of four drops to the quart. Prevention of further cases is of the utmost importance. Scouring in calves in the majority of cases must be put down to bad management, but there are cases when one cannot tell what the cause is. The farmer cannot go wrong in treatment, however, if he gives the animals a laxative to clear out the bowels at the commencement, and sees that all the feeding-utensils are scrupulously clean. If the calves are in a pen, this should be cleaned out and disinfected.

Scouring in older animals is generally seen in yearlings, and is nearly always the result of parasites in the fourth compartment of the stomach and the small intestines. The worms generally found are of two sorts, and both are generally present. The larger one is about ½ in. or more long, and is known as *Strongylus contortus*, owing to its having a somewhat twisted form. The other one—named *Strongylus cervicornis*—can hardly be seen by the naked eye, and is by far the worse of the two, as the worms generally coil themselves up in the walls of the stomach. In consequence of this burrowing, it is hard to get any remedy to affect them. Generally speaking, if the farmer can get his yearlings through the winter and early spring they are safe. To do this the animal's strength must be kept up by means of dry feed, such as oaten chaff, &c. Feeding in these cases is far better than medicines, although lysol or similar preparations has been found to give good results. Teaspoonful doses dissolved in a pint of milk should be given in the early morning on three alternate days, then three or four days missed and another course administered. As indicated, however, it will be found in practice that good feeding is the best means of preventing loss.

BEES AS POLLINATORS IN THE ORCHARD.

E. A. EARP, Apiary Instructor.

MUCH has been written on bees as pollinating agents, but the application of bees in relation to fruit-culture has not yet received the consideration it deserves at the hands of the orchardists of the Dominion. The wide areas which have been planted in orchard during the past few years point to an enormous development in fruit-production, but the full return per acre will fall far below the maximum obtainable unless serious attention is paid to the cult of the bee. When the commercial beekeeper sees his neighbour's orchard in full bloom in the spring—particularly if nature is in an indulgent mood and donates fine windless days—he will probably congratulate himself on an abundance of spring feed, and enter into calculations as to the quantities of sugar he is thereby saved.

One would like to think his neighbour the orchardist regarded the matter as one of mutual benefit. Unfortunately, for some unaccountable reason, the average fruitgrower has adopted an antagonistic attitude towards the beekeeper. Every now and then the orchardist raises a false alarm about the damage the bees are doing in destroying valuable ripe fruit. These alarms—spread by fruitgrowers ignorant of the habits of bees—have been the means of antagonizing many owners of orchards, and of retarding beekeeping in fruitgrowing districts, to the detriment of the orchard returns. If the orchardist were told that the bees in his locality are of infinitely more value to his orchard than his orchard is to the bees his first sensation would probably be that of incredulous surprise. Yet such is merely a simple statement of fact. Perhaps the only justification for the presence of the illegal and out-of-date box hive in orchard districts was that it ensured the existence of the orchardist's greatest necessity—the honey-bee—in a district which would probably not support a commercial apiary, the reason being that bees must be kept where fruit is required.

The orchardist assists nature by caring for the tree from the time of its planting. His work is careful cultivation, correct pruning, and spraying, to combat malevolent insect-life and the organisms of disease. Beyond this he is dependent on pollinating insects. It is useless to expect wind to do the work of cross-pollination; the sticky nature of the pollen of fruit-bloom prevents it being freely scattered, and it is in this particular work that the honey-bee comes into notice

as the orchardist's best friend. The main factor in its usefulness is that, as a rule, bees exist in large numbers in the spring when the orchardist most needs them; whereas other insects usually do not attain to great numbers until much later in the season when the blossom has fallen from the trees. E. F. Phillips, in his book "Beekeeping," asserts, "It is not difficult to believe that in many orchards over half of the fruit set is to be attributed to the visits of the honey-bees. Were this estimate reduced to 10 per cent., which even an avowed enemy of the bee would consider too low, it appears that the fruitgrowers receive more actual financial benefit from the presence of the bees in the average farming community than do the beekeepers who own them."

While hesitating to advocate that every orchard should possess a hive or two—because the commercial fruitgrower could hardly expect to be able to give his bees the attention they require in the summer months—one can see that it would be immensely to the advantage of an orcharding community to encourage the establishment of an apiary in its midst. No other insect is so well equipped for pollinating purposes as the honey-bee, and also none has equally the instinct for thrift characteristic of the bee. Most insects visit the flowers to supply their personal wants; the bee works for as many as she can support. Moreover, she is conservative in her methods and works only on one class of flowers at a time. If a bee sets out to visit apple-blossoms her taste will not vary, and she will fly from one flower to another on the apple-trees, never wavering, whatever other blooms may tempt, thereby carrying out a system of cross-pollination which nothing else in nature can excel.

In fact, although the conclusion may at first seem rather startling, it is quite possible that the honey-bee is of more commercial value as a fruit-producer than as a honey-gatherer, and it is quite certain that the progressive apiarist in increasing his own income from his well-kept hives is at the same time conferring an immense benefit on his fruitgrowing neighbours. The apiarist gets little or no actual profit from the nectar of fruit-blooms, as it merely serves as a stimulant to brood-rearing in the spring; but an orchard without the services of the honey-bee would almost be converted into an ornamental plantation.

Banana-scale.—An Order in Council was gazetted on the 26th April, 1917, declaring banana-scale (*Aspidiotus destructor transparens*) to be a disease within the meaning of the Orchard and Garden Diseases Act, and extending the Second Schedule of the Act by the inclusion of the scale mentioned. By another Order of the same date the regulations in regard to the importation of fruit and plants into New Zealand were amended by the inclusion of banana-scale in the Twelfth Schedule, thus requiring affected fruit to be fumigated.

WORK FOR THE COMING MONTH.

THE ORCHARD.

J. A. CAMPBELL, Assistant Director, Horticulture Division.

THE work necessary to be done in the orchard during the dormant season is of an extensive and varied nature. During this period an opportunity is afforded the orchardist to thoroughly clean-up and renovate his trees, land, hedges, drains, &c. — in fact, practically everything pertaining to his property.

Fruit-trees can be more readily sprayed and stronger mixtures can be used now onward than at any other time, with the result that such pests as red mite, woolly aphis, &c., which were found to be troublesome during the summer-time, can be practically wiped out, making possible a fresh start with clean trees next season. The same applies to fungus diseases if the late autumn and early spring treatment is included (as it well might be) in the cleaning-up work of the dormant season.

As before stated, the work for the next few months is of the greatest importance, and should therefore be pushed on in its proper sequence as energetically as possible. Unless a margin of time is left available, the unforeseen interruptions frequently experienced may seriously interfere with the work. The necessity of making the best of the time available applies more particularly this season than previously, owing to the present shortage of experienced orchard labour as a result of the war, and the possibility of further losses in this direction taking place before all the work is through.

There are many difficulties in the way of setting out a scheme of work to be definitely followed during the winter months. These factors include the situation of the orchard, nature of the soil, age and classes of trees grown, and the diseases affecting them. For instance, although late autumn or early winter ploughing is generally advisable for aerating the soil and for the turning-under of old fungus-affected leaves and fruit, &c., it is inadvisable to treat many light soils, particularly on more or less steep slopes, in this way. Such soils should either be ploughed earlier in the autumn and sown down in a cover-crop, or the natural growth allowed to come away. The former is, of course, the better plan; but in either case the roots of the vegetation are relied upon and will to a great extent provide

against scouring. Again, stone-fruits affected with San Jose scale, die-back, and brown-rot require to be sprayed with lime-sulphur as soon as the foliage falls. Should there be no San Jose scale present, however, Bordeaux mixture would no doubt be a better spray to use. On the other hand, should none of these diseases be present, there would be no occasion to spray in the autumn at all. The same applies to pip-fruits. If woolly aphis and San Jose scale are at all bad it is advisable to check the ravages of the latter by spraying the trees with an oil spray as soon as the foliage has fallen sufficiently to allow of the work being properly done; but if woolly aphis alone is present, a strong application of oil in July, usually necessary for red mite, mussel scale, &c., may serve the purpose just as well.

Thus, owing to the necessary treatment of orchards not being uniform, all that can be done in the way of advice is to mention the work and treatment necessary, leaving the person concerned to put it into practice according to the special conditions that obtain. The work to be alluded to during this period includes the following:—

Cultivation in the late autumn where advisable, but in all cases in the spring, well in advance of the warm weather setting in.

Spraying with 8-6-40 Bordeaux mixture in the autumn for fungus diseases alone.

Spraying with lime-sulphur 1 in 15 in the autumn for fungus diseases and insect pests combined.

Spraying pip-fruits, as soon as the foliage has fallen sufficiently, with oil emulsion 1 in 20 for insect pests alone, other than red mite and mussel scale.

Spraying stone-fruits in July for red mite with oil emulsion 1 in 15.

Spraying pip-fruits in July or August for red mite and mussel scale with oil 1 in 12.

Spraying stone-fruits when the buds begin to swell, for leaf-curl, brown-rot, and other fungus diseases, with 8-6-40 Bordeaux.

Spraying pip-fruits when the buds begin to swell, with 8-6-40 Bordeaux, for black-spot.

Spraying pears when the buds show colour, with 6-4-50 Bordeaux or lime-sulphur 1 in 20, for black-spot.

Spraying apples when the buds show colour, with 3-4-40 Bordeaux or lime-sulphur 1 in 30, for black-spot.

Spraying apple-trees when the buds show colour for mildew alone, with lime-sulphur 1 in 80, or atomic sulphur 5 lb. to 50 gallons of water.

RIPE-ROT.

The method of treatment which has so far given the greatest satisfaction, and which is recommended for general application until the results of the experiments which are being carried out by the Department in the Auckland District are available, was dealt with in these notes last month. However, at the request of the recent conference of the Fruitgrowers' Federation, the summarized recommendations are reproduced as follows :—

Prune the trees as early as possible in the autumn, and thoroughly spray them with either 8-6-40 Bordeaux or lime-sulphur 1 in 15. Rake up and burn all old leaves, mummified fruit, and prunings; plough the ground, and thoroughly turn under all remaining rubbish and surface soil that was exposed during the season. Spray with 8-6-40 Bordeaux when the buds begin to swell. Thin the crop well, and spray about the time the earlier fruits begin to swell. Spray again the later varieties about a fortnight or three weeks later, using lime-sulphur 1 in 130 or 140, or 2-3-50 Bordeaux. Even these weak mixtures when applied at a high pressure may result in slight scorching, but the risk will have to be taken, a high pressure being necessary in all cases.

Since the above was first written I have received an American bulletin which, in dealing with the summer treatment of stone-fruits, advocates spraying with atomic sulphur 10 lb. to 100 gallons of water, the spraying to be done as soon as the petals have fallen, and again about three or four weeks later, with a further spraying about a month before the fruit is expected to ripen. I do not advocate this treatment, not having actual experience of the results of atomic sulphur on brown-rot, but the recommendation will be tested this season

PRUNING.

Pruning as well as being one of the heaviest is also one of the most important features of orchard work. In the latter respect it applies to young and old trees alike. Fruitgrowing in New Zealand is rapidly reaching the stage when quantity must give way to quality, and this can be attained in the highest degree much more readily from trees properly shaped and directly under control than from any other class of tree. In order to raise fruit of a maximum colour and quality full advantage must be taken of all the sunshine available. To benefit to the fullest extent in this direction an open tree must be aimed at, and no growth should be allowed to unduly shade any portion of it. The type of tree to be aimed at is one with a broad base and open centre, having its main branches methodically and strongly set. The branches forming the frame-

work of the tree should be all well placed by the time the tree reaches four years old: that is to say, they should all start well down in the crown of the tree. Once satisfactorily formed, these branches should not be allowed to further subdivide unless it is to repair some defect caused through injury. A tree is as easily grown on these lines as in any other way, and once formed it is far more readily pruned each season. Spraying is simplified, while the fruit is more easily thinned and gathered, and is otherwise superior in quality and colour so long as other matters, such as shelter, cultivation, manuring, &c., are properly attended to. As a type, this applies to practically all our deciduous trees, details of treatment varying according to class and variety.

In raising a tree of this kind it is essential that every care should be taken in the operations of pruning in the winter, disbudding in the spring, and thinning out in the early summer, so that the fullest advantage can be taken of the best-placed growths with the least amount of check to the tree.

POULTRY-KEEPING.

F. C. BROWN, Chief Poultry Instructor.

JUNE is the month of the year when the pullets must be principally relied upon to produce the main egg-yield. The majority of the hens are taking their natural rest, and will not lay well again until the spring arrives. Therefore the chief aim of the poultry-keeper at the present time should be to give the pullets the very best of attention, in order that they may produce their maximum yield of eggs — proper housing, feeding, and sanitation being the main factors involved.

HOUSING.

It should be borne in mind that winter eggs are an artificially induced product, and that artificial methods are necessary to procure them. In order to get eggs at this season summer conditions must be provided as far as possible. When unfavourable weather prevails the birds should be kept inside the houses, where they are protected from the rain, cold, and wind. The quarters must be roomy — not merely sufficient for the birds to roost at night, but with ample space to accommodate them in comfort on a wet day. In addition, provision must be made to admit fresh air and sunshine to all parts of the inside. Care must be taken that the quarters are free from draughts—that is, while the front of the house may be open or partly open, there should not be

any open spaces in the side or back walls. The floor should be well raised above the ground-level, in order to keep the interior of the house dry. Dampness in a fowlhouse is a frequent cause of outbreaks of disease and reduced egg-yield. The birds should never be allowed to wait about outdoors on a cold, wet day for the attendant to come and feed them. They should be fed in the house at all times, the grain rations being scattered in dry litter. This will *induce the birds to take exercise, which is an essential in the maintenance* of good health.

FEEDING.

If eggs are to be secured in heavy supply in cold weather the birds must have everything in their favour, and one great essential in this respect is to provide an abundant supply of the most desirable food. It is always poor economy to keep fowls on a merely living-diet, but especially does this apply to the laying-bird kept in confined quarters. The starving process is not so bad where birds have their liberty and an opportunity of finding natural food; but to stint a bird of its food when enclosed in a house or run is not only unprofitable but decidedly cruel. One only gets out of the heavy-laying hen what is put into it. Of course, it is possible for a poor-laying type of hen to be overfed and become too fat to lay, but such birds should never be kept for egg-production. They simply convert the food supplied them into fat, whereas the good layer turns it into eggs. It is now an established fact, confirmed by the egg-laying competitions, that the bird capable of laying two hundred eggs or over in a season will not become too fat, even if an ample supply of good food is always before her. Of course, if she is provided with the wrong class of food, her natural tendency to lay eggs may be checked and her energy diverted to flesh and fat formation.

To attain the best results not only should good sound grains be provided, but green stuff should not be overlooked. A good supply of green food is one of the best assurances of a healthy flock; moreover, when provided in abundance it materially assists in reducing the grain bill, and thereby makes for economical production. It goes without saying that a bird cannot lay to her full capacity at this time of the year without a good supply of animal food, and especially does this apply in the colder localities. Where fresh meat is not available meatmeal should be used. When mixed with the morning mash this material should be introduced by degrees, or ovarian troubles are apt to follow. Providing the pullets are well developed, and are laying or are on the point of laying, they may be given about 5 per cent. of meatmeal in the morning mash, but it should also be provided in a separate receptacle, and always left before the birds for them to pick at. This will enable them to balance

their own ration, thereby lessening the risk of ovarian disorders. Skim-milk, either for mixing the mash or when given for drinking purposes, may be used to advantage.

Needless to add, a liberal supply of clean water, gravel, grit, crushed oyster-shells, and charcoal are essential for the well-being of poultry stock of all ages, and a constant supply of these materials should always be before them.

SANITATION.

While good stock properly housed and well fed are the chief factors in profitable poultry-keeping, something more is required. No matter how good the stock, the housing, or the feeding may be, the best results will never be obtained unless the poultryman realizes the importance of cleanliness. Any neglect in paying proper attention to sanitation means that disease and insect vermin are sure to appear sooner or later among the flocks. Of course, an outbreak of disease may also take place on a well-managed plant, but in such a case it can rapidly be stamped out. It will generally be found, however, that the less sanitary the quarters are kept the sooner will disease make its appearance, the more rapidly will it spread, and the greater will be the loss from it.

The chief measure to be observed in regard to sanitation is never to allow an accumulation of the droppings. The houses should be cleaned as often as possible. Accumulated manure is not only one of the best invitations to disease-germs, but is also a good breeding-ground for vermin. The red mite, one of the worst enemies the poultryman has to guard against, simply thrives in it. As is well known, the red mite is a night marauder, hiding during the day in cracks and crevices, but attacking the birds by blood-sucking after dark. This pest can only be kept at bay by paying strict attention to cleanliness and eliminating all hiding-places. A good plan is to give the interior of the house a thorough coating of tar, and when this is quite dry to follow it with limewash. This will have the effect of covering up all hiding-places which would harbour the pest. At least twice a year—after giving the quarters a thorough cleaning—the houses should be whitewashed or sprayed with a strong disinfectant. Not only should the walls of the house be well sprayed, but also the floor. So that this may be properly carried out all manure, litter, &c., should be thoroughly cleared away. For sanitary reasons the floor of the house should be made of concrete or asphalt. To permit of cleaning the perches should be removable. They should be frequently washed in kerosene or a strong disinfectant. It is also necessary that they be placed level, and not more than 15 in. to 18 in. from the ground, so that heavy birds will not injure their feet when jumping off them.

Dirty nests provide another harbouring-place for vermin, which is a common cause of birds preferring to lay their eggs in odd corners of the house rather than in the nests. The nesting-material should be frequently renewed, and, in addition, given a dusting with insect-powder. To enable birds to rid themselves of body-lice a dust-bath should be provided. During the summer this should be made for them in a dry, sunny, sheltered place outside, and in winter in one corner of the house.

SCALY LEG.

Many cases of scaly leg have recently come under my notice in visits of instruction. This condition is usually found on the legs of fowls kept in filthy quarters. It is caused by a minute parasite which breeds under the scales of the unfeathered portion of the bird's legs and the upper parts of the toes. The parasite there irritates the tissue by attacking it with its strong mouth-parts, and as a result small blisters appear. At a later stage these dry and form a minute scale. These scales accumulate until large scaly masses appear, which gives the bird a most unsightly appearance. Usually the parasite attacks both legs at the same time. This trouble not only gives the bird a most unsightly appearance, but also affects its general health, due chiefly to irritation and loss of rest while roosting.

There are many methods of treatment, but one of the most simple and rapidly effective is to apply a mixture formed of equal parts of sulphur and lard to which has been added sufficient pure kerosene to make the whole into a more or less liquid form. This should be mixed in a fairly wide but shallow tin or similar vessel. When treating a bird a good plan is to kneel down, having the tin containing the mixture right opposite. The head and fore parts of the bird's body are placed between the knees. This will prevent the bird from struggling. The legs are held in the left hand, and dipped into the mixture, the right hand being used to rub the mixture well in with a piece of soft cloth. Care must be taken that it reaches the deepest parts. Repeat the treatment weekly until a cure is effected.

Scaly leg should never be neglected, as from one affected bird it will soon spread through the flock. A common mistake made is to think that scales on the legs are an indication of advanced age in a bird. Certainly the trouble is rarely seen on very young chicks, but it is quite common in stock from four to five months old. Many a good pullet, simply because she carried some scale on her legs, has been taken for an old hen and sent to market. Chicks should always be marked in the web of the foot when young, and by keeping a register the age of a bird can at once be ascertained. With scaly leg, as with the bulk of the troubles that affect poultry, the only sure remedy is prevention, the essential factor of which is cleanliness.

THE APIARY.

E. A. EARP, Apiary Instructor.

WEEDS.

PERHAPS at no other season is it so necessary to keep the hive-entrances absolutely free of obstruction as at present. Vegetation during the next few months is rarely dry even in fine weather, and when the bright sunshine of early winter days tempts the bees to a flight the apiarist should see that they run no risk of being caught in long grass, weeds, &c., thereby becoming chilled and losing all power of ever re-entering the hives. By removing such growths from around the hives now the entrances will remain clear for the next few months; and if the ground is treated with a dressing of agricultural salt in sufficient quantity before the spring growth starts there should be no trouble of the sort throughout the ensuing season. In no case should hives be placed directly on the ground, or the bottom boards will soon rot and have to be replaced. The hives should stand sufficiently high above the ground to avoid dampness, and it is an excellent plan to stand them on four half-bricks placed one at each corner of the bottom board.

Should the apiary be in a permanent situation, no better plan can be followed than to provide concrete hive-stands. These stands have been used in New Zealand for quite a number of years, and have saved the users a great deal of labour by preventing the growth of weeds and by affording protection against insect-life. They are expensive to lay down in the first place, but, being permanent, will remain in position indefinitely. If concrete stands are adopted they should extend a few inches in front of the alighting-boards, so as to prevent vegetation from growing too close to the entrances of the hives. In all cases the hives should have a slight cant towards the entrances, in order to permit of the water leaving the bottom boards readily. The presence of moisture will lead to much loss to the beekeeper, besides causing the hives to become sour and foul-smelling.

SHELTER.

With the approach of winter and its frequent rough weather the apiarist should turn his attention to the all-important question of shelter. Even if this provision entails a certain amount of outlay, it will in the end prove one of the greatest economies the beekeeper can achieve. Not only does he obviate the danger of having hives blown over and lids removed, with the resultant losses by cold and exposure, but he will find in the spring that the well-sheltered, warmly situated colonies have wintered with not only a minimum of

losses, but also with a minimum consumption of stores. The colony which has to winter in a cold exposed situation will require to consume far more honey to keep itself alive than the colony whose compact cluster is unaffected by cold and damp. In the latter case also the bees will have a far greater degree of vitality with which to face the strain of spring breeding. Bees require just as much attention and care at the approach of winter as at the beginning of summer, and the careful beekeeper will see that they are so treated that, so far as his hives are concerned, he can regard southerly gales, snowstorms, and severe frosts with equanimity.

TREATMENT OF WAX.

After the honey crop is disposed of and the bees settled snugly in their winter quarters the beekeeper should give attention to clarifying his wax. Where a solar extractor has been used during the summer it will be a simple matter to collect the cakes of wax which have been melted in this manner and reduce them to one or two large cakes; but where any number of combs is to be treated a wax-press is an almost indispensable article in the apiary equipment. For handling wax in large quantities the press now known as the Root wax-press is best. No special building is needed for wax-melting: an ordinary washhouse answers the purpose admirably. Choose a cold day for the operation, since nothing excites the bees during the off season like the smell of hot wax.

Commencing operations, fill the copper half-full of water, and when this is heated place the combs—which must have been removed from the frames—in the hot water. Have a strong stand ready to support the wax-press, and inside this place a kerosene-heater, so arranging it that the flame comes in direct contact with the bottom of the press. Fill the water-compartment of the press with boiling water, which the heater will now keep boiling, and in the perforated basket of the press place a coarse scrim bag large enough to reach to the bottom of the basket. The combs in the copper should be stirred with a stick until the wax is all melted, and the contents of the copper—water and wax—should then be ladl d into the scrim bag in the press. The top of the bag should now be folded so as to allow of one or more of the wooden "followers" belonging to the press to be placed on top of it and the screw placed in position, when a stream of water and wax will immediately commence to flow from the outlet provided in the press. A kerosene-tin or similar vessel should be placed in position under the outlet.

Two precautions are necessary in using a wax-press. Pressure should at all times be applied with caution. Until the flow from the press slackens the screw should not be turned, and when it

becomes necessary to apply pressure this should be done without appreciable effort. The screw should always turn easily. It will be found that if this advice is taken the maximum of wax will be obtained with very little risk to the machine. Another point to be borne in mind is that only a comparatively small quantity of water and wax must be put into the bag at each ladling. It is difficult to exactly estimate how much to treat at once, so much depends on the proportions of wax and water, but on no account attempt to fill the scrim bag at one operation. When the wax and water cease to run from the outlet the bag should be removed and the slumgum emptied out before the press is required to deal with any more wax.

As the copper will, of course, contain a great deal of water, it is an excellent plan to keep a kerosene-pump in the vessel placed to receive the contents of the press. If this is sunk to the bottom of the vessel it will draw off a great deal of the water, leaving the wax, which will, of course, be on top, untouched. This will result in the wax being gathered in far larger cakes than if several vessels are used. The wax should be set aside to cool as gradually as possible, this being best achieved by covering the tin containing it with corn-sacks or similar material. The gradual cooling helps to clarify the wax. When it is quite cold the cake should be taken out of the tin and carefully scraped.

The tin should now be washed out and partly filled with clean hot water, the cake of wax replaced, and the whole gradually heated until the wax is once more melted. After this second process the whole should be slowly cooled as before, and when the wax is once more removed and scraped it will have reached its commercial form. The wax-press and copper should be cleansed while still hot. The water should be emptied out of its compartment in the press at once, and the press placed to drain in order to prevent rust. The slum-gum must be gathered up and burnt, and the bag washed and dried for future use.

BEEKEEPERS' CONFERENCE.

The annual Dominion conference of beekeepers will be held in Wellington on the 6th, 7th, and 8th June. It is expected that all the provinces will be represented, as it is on the cards that this is to be the most important conference yet held. Among the subjects set down for discussion are beekeeping for returned soldiers, apiary-sites, and the standardization of honey-packages. A feature of the conference will be the setting-up of a committee in each province to assist the National Efficiency Board in looking after the apiaries of soldiers who have joined the colours. In order to make the conference a success every beekeeper who can afford the time to attend will be well advised to do so.

THE GARDEN.

W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.—CURRENT WORK.

THERE is comparatively little work in the vegetable-garden during the month of June. Where cabbage and cauliflower plants from the autumn sowing are large enough for planting they should be put out. Broad beans may be sown, and seakale forced. Other work mainly consists in a general cleaning-up, digging, trenching, &c., in preparation for spring operations. Jerusalem artichokes, though the tops will be dead, are best left in the ground; they shrivel if stored like potatoes. Parsnips also, though not growing, should be left in the ground till the first roots show signs of going to seed; then lift the remainder and store in a dry place, covering the roots with dry sand or fine soil.

VEGETABLES THE YEAR ROUND.

The present time is considered opportune for publishing a brief guide as to when to plant or sow the various vegetables in order to secure a regular supply throughout the year. The plan of operations given is designed for cultivators in continuous occupation. Extended periods are stated to meet cases where the proper calendar could not be followed. The dates are based on the average conditions prevailing in the middle district of the Dominion, and are subject to slight alterations to meet conditions in the north and in the colder parts of the South Island, and also for special local conditions in any part.

Asparagus.—Plant just as active growth becomes evident. Time, from mid-August to mid-September. Roots die if dormant long after lifting. Sow seed as early in spring as soil is fit.

Artichokes (Jerusalem).—Plant tubers in August before sprouting.

Beans (Broad).—Sow in June, and again in October. Extended period, sow at any time between the two stated months.

Beans (French and Butter).—Sow first week in October, and at intervals of three weeks till mid-February.

Beans (Runner).—Sow during October. Extended time, till the end of December.

Beet (Red). — Sow turnip-rooted in August, and long varieties in October. Extended period, turnip-rooted sorts to the end of January.

Brussels Sprouts. — Sow mid-September; plant out when ready. Extended period, to last week of November. Do not plant after January.

Broccoli.—Except in places where growth is very rapid, all varieties should be sown in mid-September. In other places indicated late

varieties may be sown early in November. Extended period, any time between the above dates.

Cabbage.—Early kinds are best sown during the last week in March or the first week in April, to supply the early spring crop. If sown earlier, many of the plants bolt to seed, a tendency that is present even in plants sown at this time. Sow larger varieties in August, and again towards end of November. Extended time for sowing, any time from July to April, both months inclusive.

Cabbage (Red).—Sow in July or August. Late plantings seldom succeed.

Cabbage (Savoy).—Sow early in November. Savoys are only of value during winter, and earlier sowings should not be made.

Carrot.—Sow a small lot of a short-horn type as early as possible—the first week in July if it can be done. Sow main crop of larger kind early in November. About the middle of March sow an early kind to supply tender roots. Extended period for sowing, any time between July and March, both inclusive.

Celery.—Sow in July under glass. Later sowings may be made in mid-September. These two sowings will supply the season. The plants from the September sowing will stand as late in spring as those from later sowings, and will grow larger. Extended period for sowing, any time from July to the end of November. Heads from late sowings will be small, and will not stand longer than the earlier crop.

Cauliflower.—Sow two kinds during the last week in March or the first week in April—an early and a giant kind. Sow a giant kind in mid-September. Extended period for sowing, beginning of July to September.

Lettuce.—Sow first week in April, and again every fourth week from beginning of July to near the end of February.

Onions.—Sow large varieties during the last week in March or first week in April. The plants are to be transplanted in spring. This sowing is necessary to secure very large bulbs. The sowing must not be earlier, or the plants would mostly run to seed in spring. At the same time smaller varieties of long-keeping types may be sown, but this is not imperative. Keeping-varieties are, in the ordinary course, sown in spring. For pickling-onions sow at the end of November. Seed may be put in at any time during summer to provide green-salading.

Parsnips.—Sow turnip-rooted early in spring. Long varieties for main crop, from the middle of September to the first week in November. Extended time for sowing turnip-rooted varieties, to the end of January.

Turnips.—The first spring sowing should be early in August. July-sown usually run to seed without bulbing. Sow every six weeks till the middle of March, when the winter lot is sown. The time for

the last sowing may in most places extend to early in April, and in some places to early in May.

SMALL FRUITS.

Gooseberries.—New bushes may be planted, allowing them 5 ft. every way. Pruning should be attended to. Keep the bushes open; four main branches are sufficient to start with. The following winter shorten the leading branches to about 10 in., and from each shortened leader select two new leaders. This duplication should be continued each year till the bush is high enough. No branches other than the leaders indicated should be allowed. Keep the bushes sufficiently open to render fruit-gathering easy. This condition exposes every part of the bush to a sufficient amount of light and air, and promotes fruit-bearing on every part of the bush, thus securing a maximum quantity of fruit with a minimum amount of labour and trouble. The annual shoots should be differently treated according to their position and strength. The strongest laterals should be on the upper and outer parts of the bush. Cut out entirely extra strong growths on the inside of a bush, leaving no snag. All medium and short growths in that position should be cut back to spurs about ¾ in. long, except those on the upper parts of the branches; the latter, together with all others of a similar character on the outside, except those on the lower part of the branches, should be merely tipped, taking off about one-fourth of their length.

Red Currants.—These bushes never bear fruit on young wood; all fruit is on spurs on wood that is two years and more old. The bushes should be trained up in the way described for gooseberries, but all lateral growths should be spurred back. Some amount of summer pruning will be necessary to cause red currants to do their best.

Black Currants.—On account of the borer trouble, black currants require different treatment to either of the foregoing. The only way to beat the borer appears to be by occasional renewal of branches. To enable this to be done the bushes should be raised from cuttings which have all the buds intact. These bushes will push up branches from beneath the surface of the soil. They will continue to do this throughout their life, and this affords the opportunity for occasionally cutting out old branches that have become worm-eaten, and leaving new branches to take their place. Fruit is borne on young wood as well as on spurs on older wood. Young shoots should be tipped when pruning, as the buds on the tops are not matured. Make no attempt to keep an open centre, but carefully avoid crowding the branches.

Raspberries.—All last year's bearing-canes are dead and should be removed. For each clump select up to six of the strongest new canes, and cut off about one-fourth of their length. All other canes

should be dug out. Raspberry-canes are frequently weakened by allowing too many to grow during summer. Superfluous canes rob of moisture and plant-food those that should be fostered, and further weaken them by the crowded state they cause, excluding light and air.

New plantations may be made at any time during the next two months. Small canes that are furnished with a good bunch of roots and that are taken from well outside the old clumps are better than larger canes with poor roots, as usually is the case with larger canes. Whatever the size of the canes may be, they should be cut down to two or three buds.

Loganberries.—If sufficient new rods have been made to furnish the allotted space all the old rods should be cut out. New rods should be shortened sufficiently to remove the thin portion. Rods will fruit two seasons, and therefore may be left a second season if wanted. In such cases the laterals that bore fruit should be cut back to spurs.

THE FLOWER-GARDEN.

Chrysanthemums out of flower should be cut down, and the soil between or around the stools forked over. The desire now will be to secure a good break of offsets from the stools. In stiff soil, or soil that is wet, the stools frequently do not break up freely. Aeration of the soil helps them, and in persistent wet weather this may be extended to lifting the clump somewhat by thrusting the fork under it and prizing it up, so as to admit air freely. It is necessary to guard against slugs, which are very partial to the young shoots. Liming after dark or in the early morning is the best way to kill the slugs. Choice varieties may be further protected with a ring of tobacco-dust or a piece of bright tin thrust into the soil and encircling the plant. To induce a plant to break it is sometimes necessary to lift it into a flower-pot and put it under glass.

Dahlias should be cut down to near the ground. The tubers keep safest in the ground. Loosen the soil above the clumps, and break it up so as to leave no cracks, or slugs and woodlice may get down and eat the rind about the collars, where the new growth starts. Lifting for purposes of dividing, &c., can be done several months hence.

Herbaceous plants of almost every species may be transplanted. Violets are the exception, in so far as it is not good policy to move them till after they have flowered; but for purposes of introducing fresh plants to a garden they can be planted without loss, and they will flower, but not to the same extent as if left alone.

In many places the month of June is a bad time for planting trees and shrubs. This is a matter ruled by local conditions. Where these are cold or the soil is wet, it is best to defer planting for a month or more.

ANSWERS TO CORRESPONDENTS.

In every instance a question to which an answer is desired in the *Journal* must be accompanied by the full name and the postal address of the inquirer, not necessarily for publication, but as a guarantee of good faith. The question should be written on one side of the paper only.

WIND-GALLS IN YOUNG HORSES.

W. STANTON, Victoria Valley :—

I have a young mare rising five years, part thoroughbred, and in splendid condition. She has had very little work and none at all in harness. She is now showing wind-galls on every leg—worst on the front legs. How do you account for it, and what is the cure?

The Live-stock Division :—

Many cases of wind-galls in young horses which have not done much work are due to a predisposition. The following treatment is recommended: Apply cold water for about one minute to each leg by means of a hose or watering-can, rub dry with a cloth and massage with the hands. A dry flannel bandage should then be applied fairly tight, with a slight packing of cotton-wool or tow in the hollow between the bone and the back tendons, the idea being to get an even pressure of the bandage all round and especially on the bursal enlargements. This treatment should be followed up once or twice a day, and continued for some time after the enlargements have disappeared. In obstinate cases a blister should be applied.

SPENT BREWERY-HOPS FOR GARDEN.

"INQUIRER," Reefton :—

Would brewers' hops (residues after brewing) be of any value as a garden manure, and how would they be best applied? If of any value, would it be advisable to use them fresh, or should they be left to rot?

The Horticulture Division :—

Spent hops from a brewery are useful for garden purposes. The value probably lies more in the mechanical effect they exercise on the soil than as a manure. The hops should be exposed to the weather several months before being used. The most beneficial way to employ spent hops is as a summer mulch, digging them in after the hot weather has passed.

ERADICATING PASPALUM.

"RETLAW," Kawhia :—

Do you think that summer fallowing would have good effect in eradicating paspalum; or what steps would you suggest? There is about half an acre overrun with it in a paddock that I wish to put turnips in next year.

The Fields Division :—

We would suggest winter ploughing of the paspalum, followed by summer cultivation, with taking up and burning of the roots. Delay the sowing of the turnips as late in the season as possible, and in this way you might get a good crop even if the paspalum was not killed with the summer treatment. It is more than probable that paspalum will again establish itself after the turnip crop, as paspalum-fields are always full of seeds that germinate readily after the ground has been well worked.

BORER AND BLACK APHIS IN ORANGE-TREES.

A. R., Opotiki :—

I am much troubled with the borer in my orange-trees. Also the young shoots of the trees are simply covered with another pest—the black aphis. Would you kindly supply information regarding remedies.

The Horticulture Division :—

In the case of borer, all dead twigs should be removed. Weedy growths in the centre of the tree are liable to die because of insufficient light and air, and such growths should also be removed. When a borer has entered a twig the twig should be cut off below the point of entry, as the borer always works downwards, at least in the first place. When a borer has entered wood that is too thick to be cut off inject in the hole sufficient benzine to fill it. A small oil-can will answer the purpose. A piece of wire pushed down the hole may kill the borer. After treatment stop the hole with clay, or a spill of wood. If a tree is very badly affected in the old wood the tree should be somewhat severely headed back, in order to induce new growth, a treatment that orange-trees readily respond to.

The black aphis may be destroyed by spraying with vistolene or "Black Leaf 40," the latter in the proportion of 1 part to 300 of water.

RENEWING A PASPALUM-PADDOCK.

"WELCOME BAY," Tauranga :—

Will a paspalum-paddock stand fire ? And what is the best means of renewing such a paddock when it has been down a number of years ?

The Fields Division :—

Paspalum, if it has been let get away in the summer, carries a fire fairly well, but generally the large amount of young growth amongst the older dried herbage stops the fire from burning rapidly enough to secure a clean burn. Burning does paspalum no harm ; in fact, it does it good. It is presumed your paspalum-paddock has got sod-bound, a condition regularly occurring in old-established fields. Some method of cultivation is necessary to open up the ground. If disking can be done it should be carried out, but in many cases if the turf is thick the disks will not enter the ground, but simply ride over the clumps of grass. If disking does turn up the ground at all it will be found to give good results. If the ground can be ploughed at all satisfactorily and then worked down, a sowing of Italian rye-grass should be made, using about 14 lb. There will be no need to sow any paspalum, as, apart from the old plants remaining, there will be an abundance of seed in the ground. The rye-grass will provide valuable feed till such time as the paspalum has become vigorous again.

CLUB-ROOT IN TURNIPS.

E. H., Kaimata :—

I have a crop of 6 acres of swedes, and the whole field is more or less affected with club-root. Can you tell me anything about the cause of the disease, and whether the whole crop is likely to be an absolute failure ?

The Fields Division :—

Club-root is a disease caused by a minute organism belonging to what are known as the slime fungi. The roots become affected, and immense numbers of spores are developed in the clubbed portions. The spores are liberated into the ground when the diseased portions rot, and they may remain alive in the soil for several years, affecting any crops of the turnip family that may be grown on the same ground. Stock also spread the spores on their feet, and possibly also in their droppings. Control is extremely difficult, although theoretically simple enough. The organism develops only in acid soils, and the neutralization of such soils with lime has long been the standard method of prevention. Liming has, however, to be very heavily carried out, and its preventive effects are not apparent for two or more seasons after application. Still, the liming of all country subject to club-root is an excellent policy. In your district, where the soil is somewhat light, very heavy dressings are not advisable, and carbonate rather than burnt lime should

be used. The avoidance of acid manures is recommended, and superphosphate should be replaced with basic superphosphate, basic phosphate, or basic slag. It is quite probable that your crop will not suffer very badly, but you should look over the field from time to time, and unless a considerable portion of the roots are rotting you might stock in the usual manner. If, however, the crop is rotting badly it will be well to feed off as soon as possible. Neither the ground, if badly affected, nor the run-off from the crop should be used for any turnip or rape growing for some seasons. The best plan would be to lay down in grass for several years, previously liming the ground with 2 tons of carbonate of lime per acre. Very often a crop may be quite generally affected, but the clubbed portions remain small and do not seriously interfere with growth. In cases of severe attack, however, the whole crop may be destroyed.

STAGGERS IN HORSE.

T. B. M., Pahiatua :—

I have a valuable half-draught mare, and have been caused considerable anxiety through her taking what appeared to be a fit a few days ago. She started trembling, with eyes flickering, and a watery discharge from her nostrils. She then staggered badly and hobbled down the paddock. On reaching the corner she fell, and lay panting and groaning for about five minutes, after which she got up apparently not much the worse for the attack. I should be obliged for information regarding the trouble, and cure for same.

The Live-stock Division :—

Staggers, or megrims, is a congestion of the brain, which consists of an accumulation of blood in the vessels—or engorgement. It may be produced by any mechanical obstruction which prevents the proper return of blood through the veins to the heart, such as a small or ill-fitting collar. Organic lesions of the heart, with regurgitation, are at times responsible for this complaint. Extremely fat animals with short necks are particularly subject to attacks. In many instances an attack of staggers can be attributed to a form of indigestion, and such being the case a horse which has once been affected should always receive careful dieting —bran mash occasionally, and feed not too heating. Treatment consists, when the attack is on, in applying cold water to the head. After recovering, the horse should be bran-mashed that day, and a dose of physic given the next morning.

CONTROL OF CALIFORNIAN THISTLE IN BROKEN COUNTRY.

ALFRED W. BABBAGE, Hauturu :—

Please inform me as to the best way of getting rid of Californian thistle on hilly country. Cutting only keeps it in check and does not kill it.

The Fields Division :—

On bush country where no method of cultivation can be carried out little can be done in the control of Californian thistle apart from cutting. Certain work can be carried out that should reduce the weed, but it is doubtful whether the expenditure necessary can be recovered. The fencing-in of definite areas that are bad, and heavy stocking with cattle from time to time during the summer, does a great deal of good, but is, if anything, more expensive than cutting. By far the most satisfactory method of control is the encouragement of vigorous winter-growing grasses on the patches themselves. If this can be done the trampling of stock over the ground during the dormant season of the thistle will tend to thicken up the sole of the grass and render conditions for the growth of the thistle unfavourable. The difficulty, of course, is to get the grasses properly established, and certain ones, such as prairie, which is excellent for the purpose, cannot be established unless a good seed-bed and plenty of soil cover is provided. The surface-sowing of Italian rye-grass and cocksfoot on patches might, however, be carried out. If the ground is more or less danthonia country the use of this grass on the patches after an autumn burn is suggested. The ground might be burnt over each autumn, which would get rid of the dry herbage, and as danthonia recovers rapidly good winter feed is secured, especially for sheep. If plenty of cattle are available it is better to heavily stock with them in the autumn rather than adopt the burning method.

TOP-DRESSING ALLUVIAL FLAT.

"WAIMATE," Port Waikato :—

In autumn last year I top-dressed an alluvial flat with 5 cwt. of bonedust to the acre. The results this past summer were not as good as I expected. What would you advise as a top-dressing next spring? The ground was rather wet and rushy. Last winter I put several open drains through it, which ran strongly all the summer and kept the land quite dry in spite of the wet season.

The Fields Division :—

Bonedust is a slow-acting phosphatic manure, and does not give striking immediate results. Your land probably requires lime, and manures will not give their full effect until lime has been supplied. You are recommended to apply either ground lime or crushed limestone, in quantity not less than 15 cwt. per acre of ground lime or 1 ton crushed limestone. This should be done any time, say, before the end of August. Superphosphate, 2 cwt. per acre, following the lime application, say, in early September, should result in a very satisfactory growth. *The lime and the bonedust should continue to exercise a beneficial effect for several* years.

TREATMENT FOR BLOWN COWS.

A. J. BLACKMORE, Shirley, Christchurch :—

Several cows in this district have died through getting blown. Kindly advise the treatment you would recommend for the trouble.

The Live-stock Division :—

The following drench should be made up and be ready to give as soon as a cow is found to be blown: Linseed-oil, 1½ pints; powdered charcoal, ½ oz.; sal volatile, 1 oz. As a help to liberate the gases from the stomach a piece of stick to act as a gag can be fastened in the cow's mouth by means of a rope over the head. Also a brisk rub with a wad of straw over the surface of the swelling will be found beneficial. Should the cow be found in a bad state and unable to rise, the stomach should be punctured by means of a trocar and canula, failing which a long narrow knife with a sharp point can be used. The stab must be made on the left side, at an equal distance between the hip-bone, last rib, and the short rib. After the gases have been allowed to escape the wound can be left open for twenty-four hours, when a pitch plaster should be adjusted thus: Paint six strips of linen with hot pitch; reheat with a hot shovel, apply in star fashion over the wound, and paint over the whole surface with hot pitch. The hair round the wound must be dry, otherwise the pitch will not adhere.

SPRAYING FOR GORSE-DESTRUCTION, ETC

"GORSE," Wyndham :—

Has your Department carried out experiments in the spraying of gorse? It would be a real boon to settlers in many parts of the Dominion if some spray were found that would destroy it at a cheaper rate than the continual grubbing that has to be done where it cannot be ploughed. Was the American spray that was to destroy the prickly pear in New South Wales a failure?

The Fields Division :—

Spraying gorse with arsenic and soda has not given satisfactory results. However, if the gorse is well cut down and burnt, the spraying of the young fresh growth with this compound checks it, and if persevered in would finally eradicate the weed; but the expense is greater than grubbing. The arsenious-oxide spray used for prickly pear has been a great success in Australia. The Department has imported a small experimental plant, but its effects on the ordinary local noxious weeds have not yet been demonstrated.

NOTE.—If "H.," Little River, will supply his or her name a reply will be sent to inquiry regarding poultry trouble.

BOARD OF AGRICULTURE.

THE Board of Agriculture held a lengthy meeting on 25th April, and dealt with a number of important matters.

Turnip-diseases.—A reply was received to the communication which had been sent to the Minister of Agriculture urging that a special officer should be detailed to conduct a full investigation of the methods of distribution of club-root disease, and to investigate the rotting of turnips in the South Island. It was stated that the matter was being gone into by the Department's expert officers as fully as circumstances would permit, and that the Board's recommendation as to a special officer being devoted largely to the work would have careful consideration, and would, if found practicable in the present circumstances, be given effect to.

Agricultural Education at Christchurch.—A letter was received from the Director and Secretary of the Christchurch Technical College pointing out that there were some forty boys taking the agricultural course at the Technical High School, and the Agricultural Committee of the Technical College Board of Governors felt that it would be a great advantage to have some assistance from the Department of Agriculture in instructing the boys. The Board of Governors had experimental plots and an orchard for the purpose of practical instruction, and hoped shortly to be in a position to appoint a specialist who would not only be able to take charge of the agricultural course, but also to give instruction in suitable centres throughout the district. The committee was desirous of having the support of the Board of Agriculture in its endeavour to obtain occasional lectures and demonstrations to the boys at the High School by the specialists attached to the Department of Agriculture in Christchurch. After conferring with Mr. Pope, Secretary of Agriculture, who expressed sympathy with the proposal, it was decided to reply that while the Department could not undertake to give a regular course of instruction, arrangements might, however, be made for some of the Department's officers in Christchurch to give occasional lectures and demonstrations to the boys, as desired by the committee.

Export of Stud Stock.—A number of replies were received in response to the circular letter sent out by the Board to the various breeders' associations in the Dominion urging that steps should be taken to prevent any stock being sold as stud stock in Australia and other countries unless accompanied by a certificate of pedigree from the breeders' associations for the animals registered therewith. Practically all the replies received supported the suggestions of the Board, and expressed the opinion that some legislation should be passed to give effect to the proposals of the breeders in regard to this matter, and to empower breeders' associations to refuse export certificates if the stock was not up to the standard.

The Poultry Industry.—Mr. Gallichan, President of the New Zealand Poultry Association, waited on the Board, and laid before the members the views of that body as to what might be done to improve the position of the poultry industry of the Dominion. A lengthy discussion ensued on the various suggestions put forward by Mr. Gallichan. Mr. Pope, Secretary of Agriculture, and Mr. Brown, Chief Poultry Instructor, were present at the discussion, and expressed their willingness to do all in their power to give effect to the suggestions that had been made in the direction of improving the industry. Mr. Brown pointed out that the first step necessary was to increase the egg-production. It was decided to hold a further meeting with the executive of the Poultry Association prior to the conference of poultrymen which it is proposed shall take place in Wellington in July next.

Forestry.—Mr. D. E. Hutchins, F.R.G.S., furnished the Board with some interesting particulars concerning the forestry question, detailing what had been done with regard to the demarcation of the Waipoua Forest in the North Auckland district, and what steps should be taken to preserve and regenerate the remaining bush country in the Dominion.

Wheat-growing.—The Board spent some time in discussing what could be done to induce farmers to grow a larger area of wheat, so as to ensure that an ampl

supply will be raised in the Dominion during the coming season. The hope was expressed that, in spite of the shortage of labour in the rural districts, there will be a good response to the request of the Government to increase the wheat-production.

Shipping and Meat Stocks.—The shipping question also received much consideration, and details were submitted to the Board showing the comparative figures for 1916 and 1917 in connection with the stocks of meat held in cold store in the Dominion. The President stated that representations had been made to the Prime Minister urging him to take steps to ensure that at the conclusion of the existing agreement between the Imperial Government and New Zealand producers to purchase all the meat available for export the whole of the stocks in store at the conclusion of the war should be taken over by the Imperial authorities, and not thrown back on the hands of the owners. The Board is again strongly urging the Minister that this matter should be pressed on the Imperial authorities with a view to the representations being given effect to.

Lime.—A number of reports on analyses of various specimens of limestone were received. The specimens which had been collected in the Mokau, Awakino, and Mahoenui districts were forwarded by Mr. Morgan, Director of the New Zealand Geological Survey, who has rendered the Board much assistance in connection with this and other matters. Quotations were also received from the proprietor of a lime-kiln at Hauturu (Kawhia) for the various grades of lime turned out from the works. It was decided to make further inquiries regarding these prices before going further into the matter of the Railway Department's regulations in connection with the carriage of lime for agricultural purposes at reduced rates.

Board's Report.—As the Board's term of office would shortly expire (it having held office for three years in terms of the Board of Agriculture Act, 1913), a lengthy report, detailing what had been done and the recommendations made by the Board since it first met, was drawn up for submission to the Minister of Agriculture.

Miscellaneous.—Among other matters dealt with were the following: Proposed legislation in regard to imported seeds; American meat trust; suggested restrictions on the removal of cattle affected with contagious abortion; improvement of the dairy herds and the milk-supply of the Dominion; and the necessity for doing everything practicable, even during the war, to stimulate the fullest development of the natural resources of the Dominion.

APPOINTMENT OF NEW BOARD.

A NEW Board of Agriculture has been duly appointed by His Excellency the Governor. The personnel is the same as that of the late Board, with the exception that Mr. O. J. Hawken (Taranaki) and Mr. W. R. May (Marlborough, Nelson, and Westland) take the places respectively of Messrs. R. Dingle and A. P. Allport, who did not offer themselves for renomination. Sir J. G. Wilson has been again named as President and Mr. J. C. N. Grigg as the Vice-President of the Board.

PRECAUTIONS AGAINST FIRE-BLIGHT.

As a further precaution against the introduction of pear-blight, or fire-blight of the pear (*Bacillus amylovorus*), into New Zealand an Order in Council, dated 16th April, has been issued, prohibiting the importation of pear, apple, or quince trees or of cuttings, buds, or any other portion of any such trees (except the fruit), from any country or place in North America or Japan. The prohibition is also extended to any other country or place unless every shipment of such trees, &c., is accompanied by an additional certificate to the effect that fire-blight of the pear does not exist in the country concerned. The Order also makes incidental amendments to the existing regulations.

PROPAGATION OF THE CAROB-TREE.

[THE following notes are abridged and adapted from the *Cyprus Journal*. That island is one of the principal homes of the carob, which, indeed, is sometimes called the golden tree of Cyprus.]

The principal methods of propagation are by sowing in beds, in pots, or on the spot where the tree is wanted; or by cuttings. It is better to sow where the tree is desired to grow, but if transplanting is desired the following instructions may help:—

Seeds should be sown (in New Zealand) in July and August. Before sowing, the seed should be placed for fifteen days in a vessel full of water or moist earth kept warm by standing in a heap of manure. When a white rootlet appears at the pointed end of the seed it is time to sow. Sow in furrows 8 in. apart. Cover the seeds with a thin layer of animal manure and water them. Do not dig the soil to a depth of more than 12 in.; it is better for transplanting not to have a long tap-root; on meeting the hard ground the tap-root divides and many small thread roots are formed. After sowing, if the weather is dry, the furrows should be watered once a week at least. If the seed is treated as directed the seed-leaves will appear fifteen days after sowing. Frequent hoeing of the beds is necessary. The plants may grow 18 in. or 20 in. the first year. Continue hoeing during the second year. The plants may reach a height of 3 ft. to 4 ft. 6 in. during the second year.

Transplant in August, when the plants are two years old. The work should be done during moist weather when the soil is soft and damp, so that the roots will not be injured—especially the tap-root, which may be half or at least one-third the length of the stem. Where the tap-root joins the stem there is a swelling or knot. From there the tap-root tapers down to a thread at the point. It has few or no side-shoots or lateral rootlets. Shorten the stem of the plant to 13 in. above this knot, and cut off the tap-root at a distance of 10 in. below the knot. Set the plants thus prepared into well-worked but not too deeply worked beds. Earth them up 2 in. to 2½ in. above the knot. Water carefully immediately after planting.

PRICE OF SEED-WHEAT.

AN Order in Council gazetted and brought into operation on 11th May, 1917, modifies the Order of 5th February, 1917, fixing the maximum price of wheat, in so far as it refers to the sale of seed-wheat. The schedule of the latest Order defines the present position as follows:—

1. Clause 5 of the hereinbefore-recited Order in Council of the 5th day o February, 1917, is hereby revoked, and the following clause substituted therefor:—

> "5. This Order in Council shall not apply to a contract for the sale of machine-dressed seed-wheat, and shall not apply to a contract for the sale of any other seed-wheat, if such contract is made with the knowledge and approval of the Board of Trade."

2. The maximum price per bushel in any month of machine-dressed wheat, sold as seed-wheat and intended to be used as such, shall be 1s. more than the maximum price per bushel, during that month, of wheat (not being seed-wheat, but otherwise of the same kind) sold on the same terms and conditions as to delivery and otherwise, as fixed by the hereinbefore-recited Order in Council of the 5th day of February, 1917.

By Order in Council, under the Regulation of Trade and Commerce Act, the wholesale price of milk for sale at Wanganui is fixed at 11d. per gallon, and the retail price at 5d. per quart.

(*b.*) To a person authorized to purchase hides and calf-skins for resale to the Government pursuant to a license issued under clause 13 of the said notice; or

(*c.*) To a person carrying on business in New Zealand as a tanner and authorized to purchase hides and calf-skins for the purposes of his business, pursuant to a permit issued under clause 4 hereof.

4. (1.) Any person carrying on business in New Zealand as a tanner may, on application to the Controller of the Department of Imperial Government Supplies, be granted a permit to purchase any hides or calf-skins which may be under offer of sale to the Government in pursuance of the aforesaid scheme of purchase by the Government; provided that no such permit shall be issued unless the Controller is satisfied that the hides or calf-skins, as the case may be, are necessary for the carrying-on of the business of the applicant and for the purposes of the internal trade of New Zealand.

(2.) Every such permit shall be issued on such terms and conditions as the Controller thinks fit, and shall be revocable at the will of the Controller.

(3.) Every application for a permit under this clause shall be accompanied by a statement showing the number of hides and calf-skins of each quality (according to the Third Schedule to the said notice of the 14th March, 1917) which the applicant has stored on his premises or elsewhere, or which he has agreed to purchase at the date of his application. Every person who has been granted a permit as aforesaid shall furnish a similar return to the Controller on the first day of each month thereafter.

5. After the commencement of these regulations no person other than a person acting on behalf of the New Zealand Government, or a person acting pursuant to a license issued under clause 13 of the notice of the 14th March, 1917, aforesaid, or pursuant to a permit issued under the last preceding clause of these regulations, shall purchase any hides or calf-skins in New Zealand.

NOTE.—Clause 4 (1–3) of the above regulations, dealing with tanners' permits, &c., supersedes clause 15 of the scheme of purchase of hides by the Government, gazetted on 14th March last.

SUPPLY OF SHEEP-DIP.

IT having been recently reported to the Department (on private trade advices from England) that the export of sheep-dip from Great Britain to New Zealand might shortly be prohibited unless official representations were made to the Imperial authorities, the following cablegram was despatched by the Government to the Prime Minister (Mr. Massey), in London:—

"Alleged here that export of sheep-dips and ingredients to New Zealand are likely to be prohibited. Please make representations regarding the extreme importance of this material to our wool and meat, and necessity of ensuring raw materials and shipping-space for Home manufacturers."

The following reply was received from Mr. Massey:—

"I am informed by Secretary of State for the Colonies that, while it is necessary to prohibit sulphur, it is hoped that it will not be necessary to interfere with manufacture of sheep-dips in United Kingdom—at any rate, so far as self-governing Dominions are concerned."

Price of Bran and Pollard.—By Order in Council, operating from 15th May, 1917, the maximum prices for bran and pollard are fixed respectively at £3 10s. and £6 15s. per ton f.o.b., Lyttelton, Timaru, or Oamaru. This supersedes the Order of 5th February last, under which the maximum prices were £4 for bran and £6 for pollard.

HIGH COMMISSIONER'S CABLED MARKET REPORTS.

London, 21st April, 1917.

Meat.—All descriptions of meat are in slow demand on account of the decreased consumption as a result of Government regulations limiting amount to be supplied hotels, &c. Home-killed beef is selling at comparatively low prices, partly owing to Government recommendation that foodstuffs should be reserved as far as possible for human consumption. New Zealand mutton, per lb., 8⅞d. ; ewe mutton 8½d. Argentine mutton, quotations are irregular, 11d. New Zealand lamb 10d. Argentine lamb, heavy-weight 12¼d., light-weight 12⅝d. Argentine chilled beef, hinds 10⅝d., fores 9⅜d.

Butter.—Market very quiet about the beginning of this week, at lower prices but now firming up, partly owing to the large supplies of Australian butter requisitioned by order of the Government. Danish salted, per cwt., 204s. to 208s. ; New Zealand, salted 202s. to 206s., unsalted 200s. to 204s. ; Australian salted 188s. to 192s. Argentine, no supplies available and no official quotations.

Cheese.—Market remains firm owing to continued small supplies. Canadian white and coloured, per cwt., 162s. ; States flats, 160s.

Hemp.—Firm market, but little offering. Government has taken control of Manila hemp business, which is therefore unsettled. Freight difficulty hinders New Zealand business. Quotations are nominal. New Zealand good-fair, per ton, £75 10s. ; fair £72. April to June shipment, New Zealand good-fair £74 ; fair £72. Manila output for the fortnight ended 14th April, 50,500 bales. St. Helena hemp on spot sold at auction for £77 15s., and tow £40 5s.

Wheat.—Market remains firm, but with rather less demand ; offerings are very small ; quotations are nominal. Australian, per quarter, 83s., Canadian 81s., Argentine 80s.

Oats.—Market remains firm owing to a good demand. New Zealand, per quarter, 55s.

28th April, 1917.

Meat.—There is a restricted demand for all descriptions of meat, and a decrease in the supply of home-killed mutton and beef. Lower prices are being accepted for Argentine mutton and lamb owing to an arrangement completed whereby after this week such will be sold at 10d. and 11d. per lb., with no weight allowance. New Zealand mutton 8⅞d. ; ewe mutton 8½d. Argentine mutton 10½d. New Zealand lamb 10d. ; Argentine lamb 11½d. and 12½d. Argentine chilled beef, hinds 10⅛d., fores 9⅛d.

Butter.—The following maximum prices have been fixed for the next two weeks : Danish, New Zealand, and Irish, salted and unsalted, 218s. ; Dutch and Australian 212s. The market is quiet but steady. Danish 204s. to 208s. ; New Zealand 204s. to 206s. for salted, unsalted 203s. 6d. to 207s. ; Irish 190s. to 193s. ; Australian, salted and unsalted, 190s. to 192s.

Cheese.—Maximum prices remain unchanged, with the exception of English cheddar, 160s. ; new season's make 145s. Market continues firm owing to continued small supplies. Canadian, white and coloured, 162s. ; States flats 160s.

Hemp.—The market remains firm. Government has fixed prices, Manila c.i.f., any position, fair £85, medium £80, coarse £78. New Zealand on spot, good-fair £76 10s., fair £74 10s. ; April to June, good-fair £76, fair £74.

Wheat.—Market firm owing to reduced supplies. Quotations are nominal. Australian 83s. ; Canadian 81s. ; Argentine 80s.

Oats.—Market firm at the advance. New Zealand 55s., nominal.

5th May, 1917.

Meat.—Prices are now higher for home-killed mutton and English lambs owing to the small supply of all descriptions of frozen meat. Home-killed beef is in fair supply. New Zealand mutton 8⅞d. ; ewe mutton 8½d. Argentine mutton, small supplies, 10d. New Zealand lamb 10d. ; Argentine 11d. ; Patagonian 13⅜d. ; North American 14⅛d. Argentine chilled beef, hinds 11⅛d., fores 10d.

Butter.—The market has had a firmer tone since last report. Danish 204s. to 208s. New Zealand, salted 204s. to 206s, unsalted 204s. to 208s. Australian, salted 190s. to 194s., unsalted 192s. to 196s. Irish 190s. to 194s. Argentine, salted 186s. to 188s., unsalted 188s. to 192s.

Cheese.—Market continues firm. Canadian, white and coloured, 162s. States flats 160s. Estimated Canadian and States cheese stocks at London, Liverpool, and Bristol are 23,000 boxes, against 74,000 at the same time last year. Port of Liverpool official figures give stock of New Zealand cheese as 6,700 crates.

Hemp.—Market quiet but firm. Government are now considering Manila freight charges. No Manila offering. New Zealand, quotations are nominal; sellers ask for fair on spot £80.

Wheat.—Market firm with more inquiry.

Oats.—Market remains firm.

12th May, 1917.

Meat.—All descriptions of meat are in small supply, and record prices are being made. Home-killed mutton and English lamb 1s. 8d., occasionally as high as 1s. 9d. New Zealand mutton 8¾d.; ewe mutton 8½d. New Zealand lamb 10d.; Patagonian lamb 1s. 3½d. Argentine mutton 10d.; Argentine lamb 11d. Quotations are nominal. Holders are not anxious to sell carcases, but by selling portions higher prices are being made. Argentine chilled beef, hinds 1s., fores 10¾d.

Butter.—The maximum price remains unchanged, and the market continues firm. Danish salted 204s. to 208s., New Zealand salted 204s. to 208s., unsalted up to 210s.; Argentine salted 186s. to 190s., unsalted 192s. to 194s.; Australian 192s. to 198s., salted; Irish salted 192s., unsalted 194s. to 201s.

Cheese.—The maximum price remains unchanged, and the market continues firm. Canadian white and coloured 162s.; States flats 160s.

Hemp.—Manila: No change to report; small business has been done with spot parcels at Government fixed prices; average output during the last fortnight 30,000 bales weekly. New Zealand: There is a good demand for spot hemp near at hand; business has been done in fair grade, March to May; high-point, shipment by earliest opportunity, £80.

Wheat.—Firm market, and fair business doing. Canadian No. 2 Hard Winter 80s.; No. 2 Manitoba Northern 81s.

Oats.—Market firm with hardening tendency.

STOCK EXPORTED.

THE following table shows the numbers and descriptions of stock exported from the Dominion during the month of April, 1917:—

Port of Shipment.	Horses.		Sheep.			Cattle.		Pigs.	
	To Australia.	To Eastern Pacific.	To Australia.	To Eastern Pacific.	To San Francisco.	To Australia.	To Eastern Pacific.	To Eastern Pacific.	To Australia.
Auckland	..	18	..	145	..	..	20	68	..
Gisborne	..	..	..	..	..	..	..	..	..
Napier	..	..	..	..	..	..	..	..	..
Wellington	1	..	..	..	..	..	..	..	..
Lyttelton	2	..	..	..	..	..	..	..	..
Dunedin	2	..	18	..	..	..	..	..	..
Bluff	..	..	..	..	..	..	..	..	..
Totals	5	18	18	145	..	..	20	68	..

The following are particulars of horses shipped: 12 draught mares, 2 Clydesdale fillies, 1 thoroughbred gelding and 2 mares, 1 light gelding, 4 pony mares, 1 foal.

CROWN LANDS.

AREAS FOR SELECTION BY DISCHARGED SOLDIERS.

SPECIAL efforts are being made by the Lands and Survey Department to provide holdings for discharged soldiers, and at the present time the number of sections available exceeds the demand. Any discharged soldier capable of successfully occupying a section may therefore now obtain land without difficulty. Advances up to £500 (including £150 for the erection of a house) are made to assist soldier-settlers in developing their holdings. *In addition to the lands already available* (particulars of which can be obtained from the Commissioner of Crown Lands for the district in which the lands are situated) the Department is offering several blocks, including the following :—

AUCKLAND LAND DISTRICT.

Streamlands Settlement.—This property contains twelve holdings, ranging in area from 61 to 360 acres. It is situated about four miles from Kaipara Flats Railway-station, and about the same distance from Warkworth. The land is suited for dairying and mixed farming. (To be opened on 25th June.)

Tapapa Settlement.—Consists of ten holdings, ranging in area from 69 to 154 acres. The property is about two miles and a half from Hinuera Railway-station, and consists of flat undulating land, with soil of a dark loamy nature. (25th June.)

HAWKE'S BAY LAND DISTRICT.

Porangahau Block.—Comprises ten holdings, ranging in area from 284 to 910 acres; good grazing-land, suitable for both sheep and cattle rearing. It is situated two miles from Porangahau. (7th June.)

Mangaorapa Block.—Contains six holdings, ranging in area from 694 to 1,066 acres, situated about six miles from Porangahau. Nearly all open country in native grass, mingi, and manuka scrub. Well suited for sheep and cattle rearing. (7th June.)

CANTERBURY LAND DISTRICT.

Craigmore Settlement.—Consists of seven holdings ranging in area from 199 to 251 acres. Situated about nineteen miles from Timaru. Generally good agricultural land. (12th June.)

In view of the fact that every suitable section is being set aside for disposal to discharged soldiers, very little land is being opened for public selection. There are, however, considerable areas available for public selection advertised in the "Crown Lands Guide."

FORTHCOMING SHOWS.

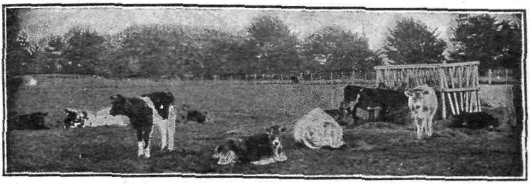
Otago A. and P. Society: Winter Show at Dunedin, 29th, 30th, 31st May, and 1st June.

Waikato Winter Show Association: At Hamilton, 5th to 9th June.

Manawatu and West Coast A. and P. Association: Winter Show at Palmerston North, 19th to 22nd June.

Rangitikei A. and P. Association: Winter Show at Taihape, 27th and 28th June.

South Taranaki Winter Show Company (Limited): Dominion Dairy Show at Hawera, 2nd to 7th July.



The

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WELLINGTON, NEW ZEALAND.

20TH JUNE, 1917.

LUCERNE-CULTURE.

SOME FACTS AND FIGURES FROM RUAKURA.

A. W. GREEN, Manager, Ruakura Farm of Instruction.

A FEW years ago practically all the exact records of lucerne-culture placed before us were those obtained in other countries, but we now have the returns from our own lucerne-fields to rely on. The present article has been prepared with a desire to convey to the man on the land the actual results possible from an established field of lucerne in New Zealand. Every care has been exercised in recording the details, and the information gathered may be accepted with all reliance. What has been achieved at Ruakura is within the reach of every one possessing land suitable for the cultivation of lucerne.

A YEAR'S RECORD.

The area of the lucerne-field here dealt with is 17¼ acres, comprising 7¾ acres sown in November, 1911, and 9½ acres sown in February, 1915. The period under review dates from 1st April, 1916, to 31st March, 1917. The following is a calendar of operations

in connection with the field during that time—with a preliminary item that from 6th to 22nd March, 1916, the crop had been cut and carted out to stock.

1916.	
19th April.	Stocked with 500 crossbred ewes.
20th ,,	Stocked with 34 heifer calves.
28th ,,	Removed 500 crossbred ewes.
1st May.	Removed 34 heifer calves.
3rd to 10th May.	Cultivated with rotary lucerne-cultivator, four strokes, and tine-harrowed twice.
1st June.	Stocked with 500 crossbred ewes.
8th ,,	Removed 500 crossbred ewes.*
23rd July.	Stocked with 45 Southdown ram hoggets.
8th Aug.	Removed 45 Southdown ram hoggets.
8th ,,	Stocked with 60 Southdown ewe hoggets.
29th ,,	Removed 60 Southdown ewe hoggets.
29th ,,	Stocked with 45 Southdown ram hoggets.
11th Sept.	Removed 45 Southdown ram hoggets.
15th ,,	Stocked with 385 crossbred ewes and 408 lambs.
23rd ,,	Removed 385 crossbred ewes and 408 lambs.
23rd ,,	Cultivated with rotary cultivator, two strokes, and tine-harrowed twice.
3rd Oct.	Top-dressed with 10 cwt. carbonate of lime per acre.
4th ,,	Closed for hay—first crop.
27th Nov.	Cut for hay.
9th Dec.	Stacked hay (measurement of stack, 39 ft. long, 16 ft. wide, 15 ft. high; estimated weight, 30 tons).
10th ,,	Closed for hay—second crop.
1917.	
16th Jan.	Cut for hay.
24th ,,	Stacked hay (measurement of stack, 32 ft. long, 17 ft. wide, 18 ft. high; estimated weight, 30 tons).
25th ,,	Closed for hay—third crop.
8th Mar.	Cut for hay.
14th ,,	Stacked hay (measurement of stack, 26 ft. long, 16 ft. wide, 16 ft. high; estimated weight, 20 tons).
16th to 21st Mar.	Cultivated with rotary cultivator, two strokes.
29th Mar.	Stocked with 245 crossbred ewes and 5 rams.

At the close of the period recorded there was sufficient feed to carry these sheep until 10th April.

* SPECIAL NOTE.—On the 3rd and 4th June two heavy frosts (9·5 and 10·5 degrees respectively) occurred. During this period the 500 ewes were left on the lucerne. No apparent ill effects resulted to either the stock or the stand of lucerne. When stock were removed the lucerne started into strong and fresh growth again.

It may rightly be stated that few forage plants, if any, could give equal results. Overcrowding of stock with the object of obtaining elaborate returns was not practised in the least: the stand of lucerne is too valuable to attempt it. In every case stock was removed in time to prevent low grazing. It is also a fact that on 31st March the stand had not deteriorated, but, on the other hand, had improved since the corresponding date of last year.

CULTIVATION AND WEEDS.

Cultivating and tine-harrowing, together with the application of lime, have undoubtedly brought about the improvement noted. The

CULTIVATING LUCERNE AT RUAKURA WITH ROTARY CULTIVATOR.

cultivator loosens up the soil and lifts all weeds, and the tine harrow following drags and shakes out the weeds. It has been freely stated that lucerne when once established requires little cultivation. This is erroneous, and to neglect attention in every detail only courts failure. Experience teaches us that lucerne requires a great deal of attention if a good stand is to be maintained. In order to minimize this work thorough cultivation and preparation of the land must be undertaken before sowing. The employment of cover-crops, followed by frequent stirring of the soil to kill the weed-seedlings, is a method advocated. The use of the tine harrow immediately the lucerne-plants are sufficiently advanced to escape danger of being dragged out is another step in the right direction. If any of the quick-growing annual weeds appear—for example, spurrey, cockspur-

grass, or red shank—the lucerne should be cut over early to prevent the weeds from seeding.

It must always be remembered that after cutting lucerne recovers quicker than weeds, and it is then that lucerne has a chance of smothering them out. Every rule has its exceptions, however, and in this case Italian rye-grass and *Poa annua* prove to be exceptions. It is hard to realize that Italian rye-grass can be a weed difficult to eradicate from a field of lucerne, but the reason is easily explained. The rye-grass recovers quickly after cutting, producing seed-heads and ripe seed before the second cutting of lucerne for hay takes place, and during harvest operations the seed is shaken out. By this means rye-grass reseeds itself annually. Germination of seed does not take place until autumn rains commence, and it is then late to do effective work with the cultivator. *Poa annua*, on the other hand, appears at its worst in winter and spring. In habit of growth this grass is entirely opposite to that of Italian rye-grass. It escapes eradication by being dwarf in habit. The plant lies flat on the ground, producing very numerous seed-heads. There is no disputing the fact that it seeds freely, and on account of its low growth running the mower over the field is useless. During early spring the land is too wet to permit the use of the cultivator. It may astonish most readers to know that docks are readily overcome. The rotary cultivator has removed every dock from the lucerne-field at Ruakura. *Poa pratensis* (Kentucky blue-grass) is a weed in lucerne which must not be allowed to remain in the stand, otherwise the plants of lucerne will soon diminish in numbers and the blue-grass will become firmly established.

Overcultivation—proving detrimental to the stand—has never yet been reported to the writer, but failure to secure a stand has in nine cases out of ten been due to weeds taking control during the first or second season after sowing. With the aid of a proper lucerne-cultivator the difficulty of weed-control becomes lessened; but, as few farmers in New Zealand possess one of these implements, the spring-tooth or the rigid-tine cultivator can be advantageously employed.

CUTTING FOR HAY.

No definite dates for this operation can be stated. The time taken for a crop to mature for hay will vary according to the weather conditions. On account of an abundance of grass three crops of lucerne hay were harvested this season at Ruakura. This seldom occurs, however, one crop at least being usually required for green feed during the months of January and February. For hay the crop should be cut when it is coming into flower. If leaf-spot is

prevalent cut early, but if not present the cutting may be delayed until the flowers are well advanced. Leaf-spot will rapidly defoliate the plants and should be carefully watched, for if the leaf falls much of the value of the hay is lost.

Lucerne, like clover, requires longer fielding than grass, and the time necessary will vary according to the weather conditions and bulk of crop. The less surface exposed during the making the better will be the quality of the hay. Turn with the swathe-turner once on the second day after cutting, and cock as early as possible. The old method of cocking is the best to adopt for lucerne hay. Cocks should be made small. When harvested in this way the lucerne

CUTTING THE THIRD CROP.

retains its green colour, and loss of leafage is reduced to a minimum. Good lucerne hay well harvested is one of the best assets a farmer can have; there is nothing better for all classes of young stock. At this station calves, foals, and lambs receive a daily supply during the autumn and winter, and it can safely be stated that no other food has given equal results. The little extra work necessary in connection with the making, so as to obtain the highest quality of hay, should not be considered. With the up-to-date haymaking plant at Ruakura it is possible to sweep in the cocks, and stack with a hay-lift. Note that unless a sweep is on wheels it should not be employed when making lucerne hay, while the method of dragging the cocks to the stack by means of a chain cannot be too strongly condemned.

Thatching should be carried out as soon after stacking as possible. A good plan is to have the thatch in the paddock before the stack. The hay is too valuable to permit loss, and under good thatch it is as safe as in a barn.

GRAZING LUCERNE.

The idea which still prevails to a considerable extent that lucerne cannot be successfully grazed is quite incorrect. Some writers state that after the cutting season is over lucerne requires to be shut up, and cannot be grazed if the best results are to be obtained from the following season's crops. This means losing the use of the land for almost six months. The wealth-producing power of lucerne cannot

SWEEPING IN THE THIRD CROP.

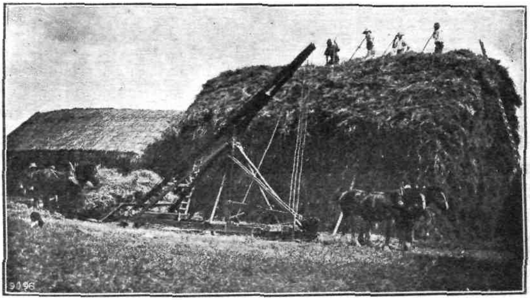
be fully utilized if a time-limit of six months is to be placed on it. In this district the annual time-limit of 365 days is the only one to be considered, and the same should apply to all districts north of the Waikato. Farther south the growing-period will vary according to the locality, and the chance of winter-killing by frost must be taken into account.

By exercising a little care at first stock can be grazed on lucerne without involving risk. Sheep should be put on for the first time about 2 o'clock in the afternoon and taken off at 5 o'clock. Restock about 10 a.m. on the following day, and remove again at 5 p.m. Restock on the third day at 10 a.m., and leave on continuously. Do not commence stocking when lucerne is wet. After stock have been on for forty-eight hours rain will not harm.

A heavy dew is more dangerous than a heavy rain, hence the advice not to stock before 10 a.m. on the second and third days. Empty stock must not be turned into a field of lucerne. It is better to stock with sheep for a few days before putting on cattle. By taking these precautions there should not be a single case of hoven (blowing) to report. Hoven is more common when the lucerne is carted out to cattle and dropped in heaps instead of being well scattered over the field.

IMPROVEMENT OF LUCERNE BY SELECTION.

It is probable that no other forage plant offers so wide a field for improvement by the selection method of plant-breeding as lucerne.



STACKING THE SECOND CROP.—HAY-LIFT AT WORK.

There is little difficulty in detecting the wide variations amongst individual plants in practically every lucerne-field. Some are of stronger growth than others, more upright in habit, and produce heavier leafage. Numerous variations also occur in regard to colour of stems, leaves, and flowers.

When walking over a lucerne-field about a fortnight after cutting, the first thing that strikes the eye of an observer is the rapid growth made by some plants in comparison with others. This alone is sufficient to force the suggestion to select these more vigorous-growing plants and discard the weaker. If rate of growth was the only qualification to be considered, isolation of these plants would be simple. They invariably produce thicker stems, thereby lessening

the quality of the lucerne hay, and, with very few exceptions, are more susceptible to leaf-spot disease. To the farmer who requires lucerne for green feed this type of plant is desirable, and to the poultry-keeper it should prove the ideal plant.

There are at present two named varieties on the market possessing these qualifications—Arabian and Peruvian. Plots of these have been established at Ruakura since November, 1911, and it can be rightly stated that in regard to rate of growth, weight of leaf, and early maturity for green feed they surpass all other varieties. Note that should these varieties not be cut early for green feed, leaf-spot will rapidly appear, causing all leaves to fall. Under ordinary conditions, and on fair average land, crops may be cut at intervals of six weeks from early in November to April.

To the farmer who intends grazing his lucerne periodically other varieties prove more suitable. Plants with larger spreading crowns, and less upright in growth, lend themselves to such treatment. In this direction, therefore, plant-breeding could play an important part. Hunter River and Marlborough are undoubtedly our best varieties at the present day, but these are open to selection, as both possess a wide range of variability.

SOME OF THE EWES GRAZING IN LUCERNE-FIELD AT END OF MARCH.
The three stacks from left represent the season's hay crops.

TRAINING-COURSES AT WERAROA.

THE training side of the Weraroa Central Development Farm was inaugurated on 14th May, when twenty-two student assistants who had joined the institution commenced the courses organized. Of the students, fourteen were accepted directly by the Department and eight are agricultural-bursary holders. For the residential accommodation of the students the erstwhile homestead of the Bartholomew property adjoining (and now incorporated with) the farm has been renovated and fitted up as a hostel. The quarters formerly occupied by cadets on the farm are also utilized for residential purposes.

PESTS AND DISEASES OF NEW ZEALAND FLAX.

PROGRESS OF THE INVESTIGATION.

D. MILLER, Entomologist.

AN investigation into the life-history and possible control of *Xanthorhoe praefectata*, the larvæ of which damage the leaf and fibre of New Zealand flax (*Phormium tenax*), was commenced during February, 1916. As had been anticipated, the investigation was extended to comprise other insects which incidentally were found to do considerable damage to the flax. Certain fungus diseases and other troubles of the flax-plant also received attention. The matter of the present article is mainly a summary of the evidence collected during the investigation up to the end of April of this year.

It may be stated preliminarily that the phormium-fields fall into two main classes—(1) the swamp areas, and (2), to a lesser extent, the hill areas. In the latter class is included the mountain-flax (*P. Cookianum*), which, though at present of no commercial value, will be referred to later on in connection with the attacks of larvæ.

Practically no hill areas cut for fibre exist in the North Island, but in Southland they predominate, in places covering the ridges and steep faces of the low hills. The flax of these areas grows in its natural state, but the swamp areas of the North Island have been drained—sometimes, as will be seen, overdrained—in order to procure a dense growth of flax. Most of the swamps are at or about sea-level, an exception being the area at Lake Tutira.

Flax varies considerably in colour, height, and shape of leaf, but no systematic arrangement of these variations has yet been published. On the whole the leaf of Southland is more rigid and takes longer to mature than that of the North Island, where more variation occurs, and it appears that flax growing in moister areas is of a darker shade of green. As far as is known, however, variations do not bear directly upon the attacks of larvæ.

In the North Island, as a rule, the flax is cut every third or fourth year, and the fibre is considered not so hard as that of the South Island, where the leaf is not cut so frequently. However, the average amount of leaf required to produce a ton of fibre does not usually vary to a marked extent.

During growth the young shoots arise from the centre of the plant, so that the outer leaves of a "fan" are the oldest, and commence to die off at the age of approximately one year and three-quarters. When withering the leaf turns inwards longitudinally along the edges, and in time forms a more or less hollow tube. These dead leaves, which either form accumulations around the plant or are supported by the green leaves, are of considerable importance in the propagation of larvæ, and will be referred to hereafter as "leaf-tubes."

The term "flax-grub" is generally applied in a vague sense to those larvæ (and even fungi) which attack the flax-leaf, but at present the larvæ of the three following species of Lepidoptera will be dealt with: *Xanthorhoe praefectata* Walk., *Melanchra steropastis* Meyr., *Œceticus omnivorus* Fereday. Of these, *Xanthorhoe* and *Melanchra* are the most prevalent and do most damage; *Œceticus* is only occasionally found.

LARVÆ OF XANTHORHOE PRAEFECTATA ON FLAX-LEAF—NATURAL SIZE.

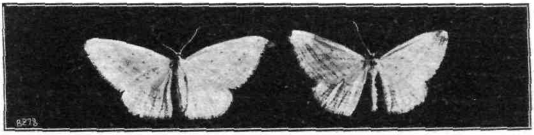
E. B. Levy, photo.

XANTHORHOE PRAEFECTATA.

The larvæ of *Xanthorhoe* attack the lower epidermis of the leaves, removing long and narrow strips of varying dimensions and exposing the fibre, which soon decays. Rarely do these larvæ attack the upper surface of the leaf. As a rule the epidermis is removed parallel to the fibre, but occasionally either in a transverse or sinuated manner. While eating the larva works backwards, and will move its head from side to side, thus at times making a cut much wider than its head; or, again, the cuts may be so narrow as to be almost unnoticeable. During the day the larvæ are to be found sheltering in the dry leaf-tubes, and several specimens may be taken together. They do not frequent those leaf-tubes lying on the ground, since the latter as a rule are damp, the larvæ certainly preferring the dry shelters. Immediately after flax has been cut the larvæ may also be found in the axils of the outer dead leaves where dry. It is usually found that where there are practically no accumulations of leaf-tubes—which is usually correlated with the presence of moisture—

the larval attacks are comparatively absent. When *Xanthorhoe* is present and the leaf is considerably older than usual the accumulated attacks of the previous years give a very badly damaged appearance to the leaf—more so than if the flax had been cut earlier. This is seen at Pahia and on the mountain-flax of Arthur's Pass.

If during a flood the water does not cover the flax-bushes or completely immerse the leaf-tubes, the larvæ will still shelter in the unsubmerged portions of the latter, or hang suspended by threads amongst the denser foliage. An experiment carried out in the laboratory showed that the larvæ do not usually become agitated until the water has touched or covered the head, so that if the larvæ are resting perpendicularly, head uppermost, the whole body may become immersed before they attempt to crawl out of the reach of the water. When resting head downwards the tendency is, when the water reaches them, to crawl downwards to some opening in the



E. B. Levy, photo. FEMALE. MALE.

MOTHS OF XANTHORHOE PRAEFECTATA—NATURAL SIZE.

leaf-tube before attempting to reach safety. As the water rises the larvæ move higher up the leaf, eventually holding on to the apex when it becomes immersed, and, standing more or less erect, feel round for some further support, such as a floating leaf, twig, or even a bit of grass, which, if present, is immediately grasped. A larva will live for a considerable time upon such a float, but not in the direct sunlight. If no such support is to be had the larva will eventually float off on the surface of the water, where, if it continues struggling, it will soon sink and perish within ten minutes. A shorter immersion of less than two minutes does not, as a rule, seem to affect the vitality of the larvæ.

A specimen was placed upon a flax-leaf surrounded at the base by water. This larva made immediately for the least shelter afforded by the slightest turn of the leaf, and if turned to the sunlight would promptly move to the opposite side. It remained thus for seven days without feeding, and practically inactive, after which it dropped off and was drowned. By the morning of the

sixth day this specimen had become much darker in colour, and, as was expected, underwent an ecdysis in the evening, the old skin remaining fast to the leaf; the larva was of the normal reddish colour. On the following day it perished as stated above.

Another specimen when disturbed by lamp-light while feeding looped off to shelter, where it was content to remain with just its head hidden while its body was exposed. Specimens sheltering in this manner have not yet been found under natural conditions.

Larvæ when alarmed usually drop to the ground or amongst the flax-leaves; at times they will fall by means of a silken thread.

Colonies of this species will migrate from place to place. In the case of a badly attacked patch of flax of about four years' growth which had just been cut, and where accumulations of leaf-tubes abounded, the larvæ moved into an adjoining block and commenced their depredations.

In a block which had been cut two months previously, and where there was a fresh growth of flax, several fresh and narrow incisions were observed. On examination a number of small emerald-green larvæ about ¼ in. in length were discovered. Some of these were kept under observation, and it was found that in about four days they had assumed the characteristic reddish colour of the larvæ of *Xanthorhoe praefectata*. Generally in the daytime they were found sheltering between the outer dead leaves at the butt of the plant.

When about ¾ in. long the larvæ will burrow into the dry or very slightly moistened ground and pupate. The greatest depth any were observed to burrow in the laboratory was about 2½ in. Sometimes where the conditions are favourable a larva may pupate between two dead leaves on the ground, where it can gather together nodules of earth which it builds around itself, forming an earthen cocoon; but this is also done in the ground. The cocoon measures less than ¾ in. in length and not quite as broad. The head of the larva blocks the only opening. In these shelters the pupæ are invisible on account of their close resemblance to nodules of earth.

Dampness to any extent is fatal to the pupæ. Several were kept in a sheltered place but exposed to the rain, and were frequently soaked; the pupæ came to nothing, and eventually bore a shrivelled appearance.

The larvæ of *Xanthorhoe* first appear during the beginning of August, and in increasing numbers in the following months till about the end of December. Those feeding during March, April, and May are the larvæ which hibernate in the leaf-tubes and the offspring of the moths which appeared in the summer. Apparently the individuals

hatch at different periods, as young and old are found attacking in the same patch of flax. This would be less so in those colder localities where the seasons are more sharply defined.

In the immediate vicinity of bush areas, particularly where there is a dense undergrowth or scrub growing with the flax, the larval attacks are less marked. This may be partly due to the presence of a greater number of insectivorous birds and parasitic insects which are found in those bush areas, and not deeper in the swamp, where there are no such shelters and where these birds and insects are not nearly so abundant, and partly to the increased moisture caused by the presence of such bush areas.

Two cages for birds were erected in the Makerua Swamp, but owing to the exceptional rarity of the larvæ during the past season extensive experiments and observations could not be carried out. The reason of the larvæ being so scarce was probably due to the heavy floods during August, when the larvæ were first appearing. A patch at Tokomaru which was the most severly attacked and had been kept under observation was unfortunately destroyed by fire.

Xanthorhoe praefectata has a distribution throughout New Zealand, and is found not only at sea-level but at an elevation of 4,500 ft. The imagines may be found from November to May.

MELANCHRA STEROPASTIS.

The larva of *Melanchra steropastis* is most abundant upon the hill-flax of Southland, but is found throughout New Zealand. Its manner of attacking the leaf differs from that of *Xanthorhoe*; instead of removing the lower epidermis this larva cuts notches from the edge of the leaf, removing the fibre as well as the epidermis. The prevalent idea was that those notches were caused by the wind rubbing two leaves together along the edges, saw-fashion.

The general habits of *Melanchra* larvæ resemble those of *Xanthorhoe* in the manner of seeking shelter in leaf-tubes, but the former are less sensitive to light than the latter, and are found in both moist and dry localities practically throughout the year. They sometimes pupate in the leaf-tubes, but though they also burrow in the ground they have not yet been observed to pupate there. These larvæ when full grown are larger than those of *Xanthorhoe*, and have a pinkish colour.

The larvæ of *Xanthorhoe* and *Melanchra* may be distinguished not only by colour and manner of attacking the leaf, but also by the presence on the latter of four pairs of pro-legs just beyond the middle, as compared with the single pair on the former toward the posterior end.

In dry flax areas where the larvæ exist it will be found that though the ground will be soaked by heavy rain-showers there is usually a dry belt surrounding the bushes under the shelter of the leaves, but not in immediate contact with the base of the plant; the soil adjoining the base is sodden owing to the rain-water running down the leaves. The dry leaf-tubes, which are usually hard and firmly rolled, remain perfectly dry within.

ŒCETICUS OMNIVORUS.

The larva of *Œceticus omnivorus* is found throughout New Zealand and is active most of the year. As yet it does no serious damage to the flax, and is never found in any numbers in those areas. The larva varies considerably in length, and lives in a case which it carries with it. It feeds during the day. This species removes the lower epidermis of the flax-leaf in circular patches, varying from small to very large areas. Sometimes not only the lower epidermis, but also the fibre and upper side are devoured, thus leaving small to very large holes in the leaf. In one instance a specimen measuring fully 2½ in. in length had cut a large circular hole some 3 in. in diameter.

SUGGESTIONS FOR GRUB-CONTROL.

Three methods of control (used in conjunction) suggest themselves at the present stage of the investigation—namely, (1) artificial flooding, (2) parasitic insects, (3) insectivorous birds.

As has been pointed out, the attacks of both *Xanthorhoe* and *Melanchra* are practically a nonentity in localities which are regularly flooded by either river or storm water, and where the leaf-tube accumulations are not abundant, these two features being, as a rule, correlated. In overdrained swamps and in very dry localities, such as hillsides, leaf-tubes are numerous and afford excellent shelter for the larvae; also, from experiments, it seems that the soil of such places is suitable for their pupation.

An apparent exception is a patch of flax on Mr. W. H. Field's property, at Waikanae. Here the attacks had been serious until lately, when the only signs of damage are on the older and outer leaves. This flax is being kept under observation.

An excellent example of the correlation of larval attacks and leaf-tubes was seen in certain gardens. In one place was a row of flax-bushes amongst which, on account of neglect to clear dead matter, leaf-tubes had accumulated. The leaves of those bushes had been attacked by *Xanthorhoe*, but in another part where the tubes had been regularly removed there were no signs of attack. In a

state of nature this point is illustrated at Greymouth Racecourse, Arthur's Pass, and most of the flax areas visited.

Flax of three years' growth at Waikanae, which may be classed as a moist swamp, has fewer leaf-tubes than flax of the same age in the dry north end of the Makerua.

In virgin swamps which are very wet it is certainly beneficial to drain the area in order to increase the flax-growth, as illustrated by the breaking-in of the Makerua. After draining the soil consolidates and the flax thrives, but this may be carried to such an extent as to be detrimental (also illustrated in the case of the Makerua) where the loss of moisture is in excess of the supply, bringing about conditions favourable to the existence of larval pests, and apparently causing a greater dying-off of the outer leaves. From observations, which will be checked by experiment, it seems that where an area is decidedly moist and not overdrained leaf-tubes do not so readily form. If this is so, and in conjunction with the consequent absence of larval attack, the benefits from the application of moisture would be threefold—namely, reduction in the "grub" attack, more and healthier leaf at time of cutting, and less risk from accidental fires—the leaf-tubes not only being an excellent shelter for larvæ, but also a suitable medium for the spread of fires.

The loss from fires alone is a serious problem. In the Makerua area itself three outstanding examples may be given. In 1900, 1904, and 1917 standing flax of an approximate aggregate equivalent to 9,000 tons of fibre was destroyed. This, at a pre-war rate of £22 per ton, gives a loss of no less than £198,000. By the fire of this year (1917) the equivalent of some 1,600 tons of fibre was destroyed, which, at the present war values, equals about £64,000. Adding a sum of £4,000 paid for fighting the fires brings this season's loss to some £68,000.

Thus the advantage of keeping the flax areas moist and as free as possible of dry rubbish, such as leaf-tubes, can be seen at a glance. This would be the case even if no grub existed, the loss from which, so far as can be ascertained, is approximately, at present prices, £4 10s. per ton of fibre, as compared with the yield of clean leaf.

A feasible method of applying moisture or of flooding would be by means of artesian wells, which have already been sunk in various parts of the swamps for the purpose of supplying live-stock and mills. In the Makerua the depth at which water is found varies considerably, the shallowest well being about 30 ft. Investigations into this matter are being carried out.

The application of parasitic insects will be one of the most important methods of controlling the flax-grubs. Of the parasitic

insects found in the flax areas the ichneumon flies are perhaps the most prevalent. About sixty-seven species of these forms have already been recorded in New Zealand, and doubtless one or more will be applied as a check to the flax-grub.

At Otaitai Bush (Southland) last March I found that the grubs sheltering within the leaf-tubes of the flax were severely parasitized by what appears to be an ichneumon. This is being gone into carefully, and it is hoped that before long definite information will be obtained upon the life-history of this species.

During last season, in the Makerua, a fly, *Syrphus ortas*, usually considered rare, was found in considerable numbers throughout the swamp, particularly in the vicinity of bush and also where the grubs were attacking. This species and the flax-grubs increased simultaneously. From one of the Makerua larvæ, kept in the laboratory, a female of this fly was reared, which showed that *Xanthorhoe praefectata* constitutes one of its hosts. The presence of *S. ortas* in the bush area was probably due to the fact that another host (or hosts) was among the numerous larvæ found in such places. The occurrence of *S. ortas*, combined with the severe floods during last August, probably assisted in the unusual reduction of the flax-grub in the Makerua during the past season.

Insectivorous birds doubtless play an important part in the reduction of larval pests, but usually they confine their attention to the bush areas, and do not venture far into the swamps.

OTHER FLAX PESTS AND DISEASES.

Several scale insects infest the flax-leaf in certain areas. Some of these (*e.g.*, *Poliaspis media*) when present in large numbers cover the shady sides of the leaves with a white and woolly mass, and exude "honey-dew" in considerable quantities. This honey-dew is frequently attacked by a sooty mould, the leaves becoming softened. It is said that such leaves reduce the quality of the fibre to "Common" grade. These scales are found in considerable numbers in Canterbury, the Moutoa, and parts of the Makerua areas, as well as elsewhere.

Large quantities of phormium-leaf are also attacked by a reddish fungus, which may completely cover the under-surface and appear through the tissues upon the upper. This is very common in the Manawatu district. The fungus appears first in spots, which gradually spread.

The leaves attacked by the scale insects, mould, and fungus commence to die off at the tip. The red fungus, by discolouring the fibre, seriously affects the grade.

Another serious trouble has become more evident of late in various flax areas. The leaf commences to turn a bright yellow from the apex downwards, and eventually dies off. Considerable areas in the Makerua have been thus affected during the last season. The reason for this condition is as yet obscure, but the plants throwing off new roots may recover. "Yellow-leaf" is found in both dry and wet localities. The affected area at Rangitane (Makerua) is one of the driest parts of the swamp. The trouble is also observed throughout New Zealand in virgin swamps where the flax is stunted and under water. Again, it is seen, but to a less extent, upon extremely dry hillsides. It has become evident this season in places where formerly it had not appeared. At Te Puke yellow-leaf is the only serious flax trouble which affects the industry. In wet areas not only the flax but also other swamp vegetation is thus affected, in certain cases even the cabbage-trees showing signs of the trouble.

On the roots being examined it is found that black patches discolour many of them, and in severe cases the whole root is thus affected. A bush which had all its outer leaves yellow but the inner ones normal was dug up, and it was found that the older roots were completely blackened, while the younger ones were healthy. This was during last February near Whangarei, where last year there were no signs of yellow-leaf. The crown of the plant is usually unaffected.

The roots of the diseased plants dug up at Rangitane showed signs upon the outer sheath of an insect borer of some species, but this was not found to be the case with diseased plants in other parts of New Zealand. A flax-miller remarked that, according to his observations, the yellow-leaf trouble appeared after very wet periods, but that the flax again recovered if the following seasons were normal. This may account for the appearance of the disease in dry localities during the last season—taking into consideration the fact that it prevails in most of the virgin swamps which are usually under water.

NOTE.—An account by Mr. Miller of the Makerua and Moutoa flax areas, bearing on the incidence of larval attack, will appear in an early issue of the *Journal*.—EDITOR.

It is always a fatal mistake to economize in the poultry feed-bill by giving the birds a smaller allowance. Better to feed half a flock well than put a whole flock on half-rations.

POTASH IN AGRICULTURE.

III. FURTHER RESEARCHES.

B. C. ASTON, F.I.C., Chemist to the Department.

In science the faith of to-day may become the heresy of to-morrow. For years one has been taught to believe that lime liberates potash from the soil-silicates and makes it more available for the use of plants. Now this theory is being attacked. Lyon and Bizzell,* referring to experiments conducted by them, say: "So far as could be ascertained from the K_2O (potash) in the drainage-water and the crops raised on the soil treated with lime and the soil not treated, there was no liberation of potassium effected by the lime treatment." F. B. Guthrie† states that experiments in the chemical laboratory of the *Department of Agriculture, in Sydney, "indicate that at least in limed* soil in which no crop was grown there is practically no increase in the amounts of available potash and phosphoric acid after a month over that produced in unlimed soil, and that in loamy or clay soils *the original water-soluble potash has decreased."* E. W. *Gaither,*‡ of the Ohio Agricultural Experiment Station, also supports this view, for he concludes that the theory is either erroneous or requires more positive proof than has heretofore been obtained before it can be *accepted. Prianishnikov, quoted by Biéler-Chatelan (in Compt-Rend.* Acad. Sc., 1910, p. 1132), shows that in muscovite (common mica) there is at least one silicate the potash of which is rendered more soluble by lime.

Briggs and Breazeale§ conclude from their experiments with powdered pegmatite and orthoclase with virgin granitic soils that neither calcium hydrate nor calcium sulphate acted in the direction generally supposed. Calcium hydrate did not modify the solubility of potassium in either pegmatite or orthoclase finely ground, and the sulphate depressed the solubility of the potassium in orthoclase, the quantity of potassium decreasing progressively as the concentration of the calcium sulphate increased. In the soils the solubility of the potassium was not measurably different in solutions of water and in *solutions of calcium hydrate or calcium sulphate.* Wheat-seedlings grown in water-cultures with finely ground orthoclase and in a saturated

* Journal American Soc. of Agronomy, Vol. 8, No. 2, 1916.
† Ag. Gazette of New South Wales, Oct., 1916.
‡ Journ. Indust. and Engin. Chem., July, 1910.
§ Journ. Ag. Research (U.S.A.), 1917, p. 28.

calcium-sulphate solution containing the same quantity of orthoclase showed the same potassium-content. Calcium sulphate in soil cultures induced decrease in the absorption of potash by wheat. In brief, the experiments indicated that the availability to plants of the potash in soils derived from orthoclase-bearing rocks is not increased by the addition of lime or gypsum. In some instances, as mentioned, a marked depression of the solubility of the potash in the presence of gypsum was observed. These conclusions were based both on the results of the analyses of the solutions and on the measurement of the potash-content of wheat-seedlings grown in the solutions.

FARMYARD MANURE.—FLAX-REFUSE.

All crops which produce large quantities of carbohydrates (sugars, starch, cellulose, &c.) require and assimilate comparatively large quantities of potash. At the present time when starch-production for food is so desirable it will be apposite if some consideration be given to the means by which potash-demanding crops, such as potatoes, mangels, &c., which have a limited root-system and short period of growth compared with perennial crops like phormium and sugar-cane, may be supplied with the potash which at present is lacking from nearly all compounded fertilizers at present on the market.

A great waste of potash is going on wherever stock-urine or the liquid portion of stable manure is allowed to run down the drains. In this country, where stock are not usually stall-fed, the urine is distributed over the paddocks and is not lost, although the distribution might be more evenly performed. The potash put on the soil in this way is not lost, but becomes fixed in the soil. Stable and farmyard manures contain anything from one-third of 1 to 1 per cent. of potash, and are valuable potato-manures, not only for the potash but for the nitrogen, and for the excellent mechanical effect they produce on the soil and in alleviating the effect of droughts and floods, to either of which the potato crop is remarkably intolerant.

A substitute for stable manure is flax (phormium) refuse, which may be obtained from any flax-mill. This contains about 0·7 per cent. of potash (or 2·1 per cent. on the dry matter), and has the additional merit that it does not contain any weed-seeds, as stable manure is apt to. Either stable-refuse or flax-refuse may be applied in any quantity from 10 to 30 tons per acre with advantage.

MORE ABOUT SAWMILL ASHES.

As indicated in previous articles, another great source of waste of potash is in the wood-ashes of sawmills. If these were stored in air-tight receptacles until cold and then parcelled up, they should readily find a market among farmers desiring a lime-and-potash fertilizer.

The ashes of a sawmill are of two kinds—that derived from the burning of slabs under the boiler, and that from the sawdust and refuse dumps The former is easily handled, but the latter would require some ingenuity to deal with. In a large mill the sawdust dump, mixed with slabs and other wood-refuse, is set on fire and allowed to smoulder away, the rate of burning depending on the wind and rainfall and other varying factors. The rain leaches the soluble potash carbonate out from the top layers and leaves the ash poor in potash but richer in other constituents. If the heat be too great some of the potash may be rendered insoluble by combining with the silica.

An efficient sawdust-destructor which will dispose of the sawdust as it comes from the saws wet and containing 50 per cent. of water, and reduce it to an ash containing all the potash in water-soluble condition, would be a great boon to every large sawmill, as sawdust-disposal is distinctly a problem in New Zealand. Not only has labour to be expended in carriage to a distance where it may be fired, but a smouldering fire is always a source of anxiety. The ashes of the sawdust dump are difficult to deal with, although they should be an excellent source of potash. Carbonate of potash, which is the valuable part, is easily leached away by the atmospheric moisture, rain, and dew, and runs to waste, or may be fused with excessive heat into an insoluble clinker. When there is a good breeze blowing and the sawdust is burning well in dry weather it is difficult to approach the burning mass. In wet weather it is almost impossible to do anything.

Some idea of the value of sawdust ash may be gained from a perusal of the analyses given in the *Journal* for October, 1915, page 290. Further data are supplied by the following analyses of samples collected at the Auckland Rimu Timber Company's mill at Ngongotaha, near Rotorua. Here the sawdust, mostly from rimu (red-pine), is fired alongside the company's private line, from which it is dumped. The fire is kept within bounds by quenching with pumice-dust from time to time.

TABLE I.

Lab. No.	Potash (K_2O), Water-soluble.	Phosphoric Anhydride (P_2O_5.)	Calcium Carbonate ($CaCO_3$).	Approximate Value per Ton of Ash.
				£ s. d.
J/50	4·26	Trace	11·74	2 17 6
51	0·84	,,	12·05	0 12 6
52	7·19	,,	27·44	4 15 0
53	5·68	2·96	9·50	4 4 6

J/50 was collected from the surface of the heap, and is probably uncontaminated by pumice.

J/51 was collected by inserting a soil-sampler 6 in. or 7 in. into the mass, and is largely contaminated by pumice.

J/52 was the extreme surface skin of ash on the top of the dump.

J/53 is a sample from the stokehole dump, being ashes derived from burnt slabs of rimu, and yields 9·26 per cent. K_2O to hydrochloric acid.

Furnace ashes are often clinkered and some of the potash and silica fused into a condition insoluble in water.

Assuming that potash is worth 12s. 6d., phosphoric anhydride 4s., and lime 4d. per unit (12s. 6d. is the value recently used for potash in England), the ashes would have the values stated in the table.

Let us take another example, a mill producing mostly totara and matai timber, that at Mokai, as follows:—

TABLE II.

Lab. No.	Potash (K_2O), Water-soluble.	Phosphoric Anhydride (P_2O_5).	Calcium Carbonate ($CaCO_3$).	Approximate Value per Ton of Ash.
				£ s. d.
J/29	7·45	Trace	64·94	5 5 6
30	21·53	,,	54·88	14 0 0
31	18·12	,,	30·13	11 12 0
32	0·31	,,	34·09	0 8 0
33	1·22	,,	20·81	0 19 0

J/29 is a sample of totara-slab ash from the furnace dump, collected hot, and contains 8·12 per cent. K_2O when decomposed with strong hydrochloric acid.

J/30 is a sample of ash incinerated in the laboratory, from totara sawdust.

J/31 was also incinerated in the laboratory, from matai sawdust. (J/30 and J/31 require confirmation before being taken as representative.)

J/32 is a sample of ash collected from the rain-wetted heap, at the immense sawdust dump.

J/33 is a sample of ash collected hot and dry from the same heap, and yields 6·1 per cent. potash to hydrochloric acid.

Both J/32 and J/33 were contaminated by pumice.

The ash of wood is, of course, an extremely small proportion of the wood, the dry sawdust only containing from 0·8 to 2·2 per cent. of ash.

BRACKEN-FERN (*Pteris aquilina* var. *esculenta*).

In the *Journal* for December, 1916, I drew attention to a statement by Professor Berry, of the West of Scotland Agricultural College, concerning the value of bracken as a source of potash. Since then he has continued his researches, with the result that his estimate that 10 acres will produce a ton of bracken-ash containing 20 per cent. of potash has been considerably increased. In a recent paper on "Bracken Utilization and Eradication" (*Scottish Farmer*, 31st March, 1917, and 7th April, 1917) the professor shows that according to the locality a ton of ash containing the same quantity of potash may be secured from areas varying from 4 to 7 acres. He also explains the great variation in the content of potash in bracken more by the age and condition of the fronds than by the quality of the soil on which they are grown. If there is potash in the soil bracken appears to be able to extract it, no matter in what rock it originally existed; but in the case of peaty swamps deficient in potash bracken takes up much less potash.

Before seeing this paper the present writer had collected samples of bracken of various ages and from various soils. From sandy country near Foxton (J/116) and from sandy country near Waikanae (J/117) two samples of young green succulent fronds about 1 ft. to 18 in. high were taken on 28th and 29th April respectively. These on analysis gave the following results :—

TABLE III.

	J/116.	J/117.
Percentage dry matter	*18·20*	*16·00*
Percentage ash in dry matter	7·80	7·00
Calculated on ash—		
Potash (K_2O), water-soluble ..	40·81	40·50
Phosphoric anhydride	10·83	13·75
Calcium carbonate	1·16	1·25
Calculated on dry matter—		
Potash, water-soluble	3·18	2·84
Phosphoric anhydride	0·85	0·96
Calcium carbonate	0·09	0·09
Approximate value per ton of ash	£27 13s. 6d.	£28 1s. 6d.

Samples of mature fern (H/426 and J/159) gathered at Waikanae, on sandhills, on 4th December and 12th April respectively, and samples of old fern gathered in April at Te Puke (J/48) on pumice soil, and at Tarawera (J/49) on greywacke soil, yielded the following results :—

TABLE IV.

	H/426.	J/48.	J/49.	J/159.
Percentage dry matter	*43·20*	*50·00*	*51·50*	*53·4*
Percentage ash in dry matter	5·80	6·70	6·00	6·3
Calculated on ash—				
Potash, water-soluble	35·54	5·75	7·80	23·76
Phosphoric anhydride	10·37	2·37	1·84	6·87
Calcium carbonate	2·20	9·93	8·40	4·03
Calculated on dry matter—				
Potash, water-soluble	2·06	0·38	0·47	1·49
Phosphoric anhydride	0·62	0·39	0·11	0·43
Approximate value per ton of ash ..	£24 5s.	£4	£5 5s.	£16 5s.

Now, Professor Berry's figures, giving the constituents of Scottish bracken-fern, are as follows :—

TABLE V.

—	Ash, Pounds per Acre.			Potash (K_2O), Pounds per Acre.		
	Dundonald Glen (good soil).	Shewalton Moss (peaty soil).	Cleavance Hillside (shallow soil).	Dundonald Glen (good soil).	Shewalton Moss (peaty soil).	Cleavance Hillside (shallow soil).
May	41	36	..	23	19	..
June	287	296	16	152	132	9
July	556	562	111	264	239	53
August	678	642	236	289	204	106
September	601	403	323	225	88	130
October	186	132	193	40	13	20

Assuming that the Scottish fern contains the same amount of ash—say, 6 per cent. (the average of his figures is exactly 6 per cent.)—in the dry matter as the New Zealand samples, it would mean that the maximum amount of dry matter (*i.e.*, fern dried at 100° C.) found per acre in Scotland would be 5 tons. No one will dispute that the fern in New Zealand grows much more luxuriantly than in Scotland. At Te Puke 9 lb. of old green fern was taken off 4 square feet, which works out to 43 tons of green matter, or, say, 17 tons of dry matter, per acre. At Waikanae 20 lb. of mature fern was gathered off 16 square feet, which equals 24 tons of green matter per acre, or nearly 10 tons per acre of dry matter. These were not exceptional patches. It would not be extravagant to expect 10 tons of dry matter per acre at midsummer, yielding 2 per cent. of potash; that is to say, the acre would yield 0·2 (one-fifth) ton of potash (K_2O), worth, at 12s. 6d. per unit, £12 10s., or much more than the maximum Professor Berry found in Scotland.

It will, of course, occur to one as curious that the composition of the old fern differs so greatly from that of the mature and young fern. What becomes of the potash? The answer is that some migrates to the root and some is leached out from the leaves by rain. It will be noticed that in the old-fern ash there is 2 per cent. of phosphoric anhydride, and this accords with that found in the Scottish samples.

Bracken has long since been used in Wales for the production of potash for soap and glass making. If potash alone is desired it appears that it would be much more feasible to obtain it from bracken than from seaweed; the latter, however, contains iodine, a valuable by-product. But if it is true that the Chilian nitrate-deposits can supply iodine in the quantities alleged, it would be a mistake to build too much on the iodine of seaweeds as a factor in cheapening the cost of obtaining the potash therefrom. It is hard to believe that no extensive potash-salt deposits exist except in Germany. Since the war commenced one has heard of deposits in Spain, which, however, the Government of that country will not allow to be exported. America is diligently exploring her territories with a view to the discovery of potash salts, and some success is attending her efforts.* Further, a deposit of a million tons of pure muriate of potash is reported to have been recently discovered in Etruria, on the border of Abyssinia, North Africa. One is glad to hear that a British syndicate has secured this.

The utilization of plants as a source of potash should therefore only be looked on as a local alleviative of the potash shortage. As

* Alunite, a double sulphate of potassium and aluminium, after ignition gives (according to U.S.A. Bureau of Soils Circular No. 76, 1913) as good results with wheat as kelp, potassium sulphate, or potassium chloride (muriate). Alunite has been recorded from the thermal district of the North Island.

an experiment worth trying, the young green succulent fronds of the bracken might be used as a potato-manure without any treatment, simply being laid in the drills with the potato sets. 100 lb. weight of the young fronds will contain ½ lb. of potash, worth at least 3½d., besides nitrogen, organic matter, and phosphates. (For full details of potato-manuring see *Journal* for July, 1911, p. 55.)

In expressing the manurial ingredients of these ashes in monetary terms for the sake of comparison, it must be clearly understood that it is not intended that the result shows the actual commercial value of the ash to the fertilizer-manufacturer or to the farmer. If the unit prices are considered too low it is quite allowable to substitute others. For instance, a New Zealand firm has written me expressing willingness to purchase a potash salt having a content of not less than 30 per cent. of potash (K_2O), at 17s. 6d. per unit (1 per cent. in a ton); so that they offer (17s. 6d. × 30) = £26 5s. per ton for 30 per cent. potash salt suitable for manuring. Bracken-ash contains the potash in the form of sulphate and chloride chiefly, and therefore is quite suitable. The composition of J/116 (Table III) would thus be worth £37 to £38 per ton, allowing the stated price for the 10 per cent. of phosphoric acid (which is equal to more than double the quantity of phosphate of lime). Experiments might even prove that instead of incinerating the succulent young fern to an ash, thereby losing any nitrogen and the organic matter it contains, it might be more profitable to merely dry it and grind it to a powder, or when used near where it is grown to treat it as a green manure.

SUMMARY.

It seems possible that we may have to revise theories regarding the functions of certain substances hitherto held by the best authorities to be indirect potash fertilizers—that is, substances which were thought to liberate and make available for plant use potash from the soil-silicates. One of these substitutes for potash imported in larger quantities since the war is gypsum, or land-plaster (hydrated calcium sulphate); another is caustic or quick lime. It seems desirable, in view of the shortage of potash fertilizers on the New Zealand market and the great need for potash for the potato crop, the planting of which is now so extensively advocated, to examine the sources of potash which are now disregarded or largely wasted in this country. Of these, flax (phormium) waste, wood-ashes from the sawmills, or any ashes from organic refuse, any hedge-clippings or weeds, or stock-excreta (particularly the liquid portion), may be mentioned. The [illegible]shes from sawmills would no doubt show a much larger quantity of Sept. October-soluble potash were they produced at a lower temperature, the [illegible]mperature at present resulting in an insoluble siliceous clinker in [illegible]e of the potash is rendered insoluble in water. To what

extent it may become soluble in the soil is a matter for experiment. The Scottish researches quoted show that the composition of the ash of the common bracken-fern is very variable in the content of potash. The variation is consistently dependent on the age of the frond; the other factors, climate and soil, are responsible for quite minor variations. The quality of the soil, however, affects the yield of bracken per acre; the most fertile soil produces the greatest amount of bracken. The outstanding feature of the research is the extraordinarily high potash-content of the young fronds, the ash of which in some instances contained as much as 56 per cent. of potash, the average being about 40 per cent. Considering that kelps containing not more than 20 per cent. of potash are now being worked for potash, it is thought that bracken as a source of potash is well worthy of investigation. The small amount of work which has been done on New Zealand bracken goes to show that in the young stages it contains a similarly high amount of potash, but that, owing to the greater number, the larger size, and the longer growing-period of the fronds, a higher yield per acre than that of the Scottish bracken may be anticipated. This work is therefore being continued.

ENSILAGE NOTES.

W. DIBBLE, Assistant Agriculturist, Fields Division.

DURING March last a demonstration in ensilage-making was given by the writer on Mr. F. C. Yeoman's property at Opouriao, Bay of Plenty, on behalf of the local Farmers' Union. The crop used was a very fine piece of maize, as shown in the accompanying photograph. This piece of land was originally very heavy kahikatea bush. It was stumped and ploughed in the autumn of last year, and sown with oats, which were fed off on the ground during the winter and early spring. The land was then again ploughed, and the maize (Early Butler) was put in during December with a maize-planter in double drills 3 ft. apart, at the rate of 1½ bushels per acre. For cultivation the scarifier was used between the rows. Although one or two heavy storms were experienced, the crop stood up well, and was easily cut and tied by a corn-binder (see photo). This machine is simplicity itself for economically handling heavy crops of maize. Sheaves when bound averaged 60 lb. The sheaves were conveyed to the stack on sledges, and the stuff was hoisted by means of a derrick and horse. The crop when test-weighed was estimated at 36½ tons per acre. No manure of any kind has ever been used on this land.

Experience in ensilage-making has time and again demonstrated that there is no other system of providing fodder which will yield such big returns, in so short a time, and (given proper methods and implements) with a minimum amount of labour. An old grass-paddock that is running out may be ploughed up in the autumn, and then sown with rye-corn and tares, or wheat and tares, or oats and barley, for feeding down during the winter and early spring months at least once or twice, after which it can be shut up for hay or the crop made into ensilage. The land may then again be ploughed, and

CUTTING THE MAIZE CROP FOR ENSILAGE AT OPOURIAO.

planted with maize during the early part of December. This crop can be cut and fed or made into ensilage during the months of March and April, according to the variety of maize selected. Whether an early or a late variety, the land can again be ploughed immediately and sown down to grass. Thus, within twelve months the same land will have provided two or three good bites of winter and early spring feed, a stack of hay or ensilage, and a paddock of new grass. Moreover, if fertilizers are used the land will have benefited by the treatment received.

Sep.,
Octob. The cause of feather-pulling in fowls is usually the presence o

IRRIGATION FOR NEW ZEALAND.

Paper read by Mr. F. W. FURKERT, A.M.Inst.C.E., Inspecting Engineer, Public Works Department, before the Technological Section of the Wellington Philosophical Society, 9th May, 1917.

A GLANCE at the rainfall map of New Zealand shows that there is an arid area in Otago of approximately 2,750 square miles throughout which the average rainfall is under 20 in., and on a considerable area of which the annual fall is about 12 in. In addition to this very dry area will be seen areas in Otago, Canterbury, and Marlborough, aggregating approximately 30,000 square miles, on which the rainfall is under 30 in. In the first area the ordinary rainfall is insufficient to enable the fertility of the soil to be fully utilized, and frequently the dry, hot spells occur at such stages of plant-growth that the whole crop is lost. Under such conditions it can be understood that agriculture languishes, and the tendency is for land to be held in large areas only partially developed and utilized.

Some years ago an officer of the Agriculture Department and one of the Public Works Department made an examination of a considerable part of the dry belt indicated, and reported that something over a quarter of a million acres of land badly required irrigation, and was of such a quality that it was likely to give satisfactory returns if irrigated. This estimate of acreage was at the time considered by the local population as ridiculously low, and I am sure that the gentlemen in question regarded it as conservative. From what I have since seen abroad I am convinced that a very much larger area than that indicated would be suitable for irrigation. To double the area mentioned would not be extravagant. The areas in which this land is held are large, and, for the sake of argument, let us assume that the average holding is 1,000 acres. It is probably more—much more. This gives on 500,000 acres 500 families. Now, suppose this area is to be all irrigated. The experience of America, where the area available is ample, is that 40 acres is the best average area on which an irrigator should start, and that when thoroughly experienced he may be able to manage 80 acres—with the aid of his family. The average area in the older countries is much the same, no doubt limited by the pressure of population, but the world-wide experience seems to be that 40 to 100 acres of good irrigated land is as much as a family can manage and is sufficient to return them a fair living. In order

not to be unduly optimistic let us take the larger figure, and thus place 5,000 families in the place of the existing 500. It is a rough rule that one family on the land enables another family to live in town. In New Zealand the urban population—that is, inhabitants of boroughs —is 505,598, while the rural population is 496,779. The average earnings of a family may be taken as £160, so that we thus have an increase of wealth to the State of 9,000 families × £160 = £1,440,000 —practically one million and a half annually.

Coming now to Canterbury and Marlborough, and assuming that the land which could be beneficially irrigated is in the same proportion (in my opinion it is in a much higher proportion), this would give, roughly, two million acres and a half. The area in crop in these localities in 1915 was half a million acres, and if the result of the irrigation (taking a cereal basis) were merely to increase the yield by 5 bushels per acre, this would be a gain of about £1 per acre—say, £500,000. But the result would be much greater, for as time went on and farmers saw that with the water always available they could plant with the certainty of reaping, the area under crop would increase, thus still further advancing the interests of New Zealand. At present in Canterbury there is only one-fifth of the land (not counting the tussock country) which is in grain or pulse crop and one-tenth in Marlborough.

From these generalities it can be seen that irrigation in New Zealand must have a great future. Not much has yet been done. The first irrigators in the drier regions were the early runholders, who found that the semi-droughts and hot winds of their new homes did not permit the growing of the gardens they had been accustomed to in their old homes, and they proceeded to bring in water from the nearest source, with the result that they made the wilderness blossom as the rose. This is illustrated in many of the old homesteads, such as Otekaike, Tarras, Glenmark, Cheviot, &c.

Next were the gold-miners of Otago, who brought in the water primarily for mining purposes, but were quick to realize the magic effect of the application of water to the fertile soil, and as the mines decreased in value many miners turned increasingly to the land and irrigation, with the result that instead of one crop of gold they are now taking perennial crops of all classes.

As early as 1878–81 extensive works were carried out in Canterbury to irrigate the lands lying between the Waimakariri and the Selwyn. The estimated value of the land was £2 per acre, the cost of irrigating (or, rather, supplying a little water) was 2s. per acre, and the value then rose to £10 per acre. This affected about 500,000 acres, but in parts the supply was as low as 20 gallons per day per acre, or the 130th part of what is proposed for the undertaking at Ida Valley, in

Central Otago. From time to time since then various other schemes have been exploited in Canterbury, but in no case, so far as I have been able to ascertain, has broad irrigation been practised. The water brought on to the land has only been sufficient to water the stock and supply domestic needs. In some cases gardens have been watered with evident profit.

The following Government irrigation schemes have been completed, so far as the provision of water is concerned: Steward Settlement (North Otago), irrigable area, 17,000 acres, 1 cusec of water to 200 acres; Otekaike (North Otago), 1,300 acres, 1 cusec to 150 acres. In Central Otago the Government has under construction two works as follows: Ida Valley, 14,000 acres, 1 cusec to 200 acres; Manuherikia, 10,000 acres, 1 cusec to 150 acres. The Cromwell Development Company also is carrying out a scheme to irrigate a 5,000-acre area on the Cromwell Flat, with a supply of 1 cusec to 150 acres. It may be explained that "cusec" signifies a flow of one cubic foot of water per second; it is synonymous in New Zealand mining parlance with the term "Government head" of water.

FACTORS IN IRRIGATION SCHEMES.

When considering irrigation for any locality a great many points must be considered, and information under a large number of heads must be collected. The principal factors are as follows:—

1. Is the land suitable? This includes knowledge of its chemical constituents, geological character, slope, aspect, &c.

2. Is the land available, or is it in the hands of persons who are satisfied with financial stagnation and do not wish to irrigate?

3. If the land is not available, what legal processes are in existence whereby it may be made available, and, if not in existence, what are required?

4. Is the climate suitable? This involves meteorological records of as long a period as possible, preferably exact scientific data, or, failing this, local traditions.

5. How much water will be required, having regard to the area, class of soil, proposed crops, climate, and other factors?

6. Is the necessary water available, and, if so, where?

7. Do suitable sites exist for the storage of winter rains? It is almost always the case that summer flow of streams will be insufficient.

8. Can dams be built, and canals be dug, and all the various works necessary for the conservation, transmission, and distribution of the water be constructed at such a price as will not be an intolerable burden on the land to be served?

9. Do markets exist within payable distance for the produce of the proposed irrigation settlement?

10. Can suitable experienced settlers be found who will not only take up the irrigated lands and engage to pay the necessary water rates, but who will actually make a success of the farming of these holdings?

There are other considerations, but the above are, I think, the principal. They may now be taken in order.

I. SUITABILITY OF THE LAND.

This inquiry involves soil-analysis by an agricultural chemist in order to determine whether the soil contains all the elements of fertility. If the soil lacks any essential quality, then the chemist must say what manures and how much must be added to ensure maximum returns. This is an aspect frequently overlooked. People in dry belts are inclined to think that all they want is water and their fortunes will be made. This is erroneous, as was well understood by Keelhof, the Belgian engineer, who reclaimed so much of the barren Campine. In his work on the subject he continually stresses the *importance of manure. As the water stimulates vastly increased* growth it makes a corresponding drain on the plant-food in the soil, which must be replaced.

Then the physical character of the soil must be examined, such as its power to absorb and hold water, its behaviour under tillage, tendency to waterlog, or blow away, or scour.

The slope of the ground also affects its suitability very much. If the slope is too great the tendency for the soil to work downhill every time it is ploughed is assisted, perhaps disastrously, by the flow of water. I know sunny slopes well suited in most respects for fruit-culture which could not be safely broken up, as heavy rain, without irrigation-water, would soon work havoc. Heavy rain must be expected at times even in dry belts, and the disastrous effect of thunder-plumps in certain circumstances have been recently demonstrated between Clyde and Cromwell. Such lands may be utilized for fodder-growing, but these cannot afford to pay so much as the *higher-class crops. The foregoing refers to land too steep. If, on* the other hand, the land is too flat, it may be difficult to get rid of surplus water. It may be argued that there should be no surplus water, and this is to a large extent true, but it is always found in practice that good drainage is essential where irrigation is practised. If the drainage cannot be obtained in the ordinary way it may be that a porous subsoil effects the same purpose as surface drains, or that, as in Egypt, great care in application and an intensely hot

climate may serve the purpose. It will be seen that the examination of the soil goes further than the actual surface, and takes in subsoil, and the knowledge of the ground-water level not only within the area, but for a distance farther down-stream. Experience in connection with well-established schemes shows that as much as one-third of the water applied as irrigation must be removed by the drainage-system.

The ground may be irregular and require heavy expenditure for levelling. In Italy the question of levelling is given very close attention, the heavy first cost being offset by the facility and efficiency with which the water can be afterwards spread. Under very favourable circumstances the cost of levelling, &c., may not exceed £10 to £12 per acre, but the expenditure of £20, and even up to £27, is not unknown. In Spain all ground is levelled by terracing. In America levelling is only done in one direction, parallel to the contours and check borders used.

2 AND 3. AVAILABILITY OF THE LAND.—LEGAL PROCESSES.

If the land is held either partly or entirely by private owners there is bound to be difficulty, for unanimity is almost an impossibility in a group of farmers, especially a large group. If all the land is owned by one proprietary, either personal, corporate, or national, it can be managed reasonably, but otherwise trouble will ensue. New Zealand possesses a law whereby any given area having been declared an irrigation area, canvass amongst the owners is made, the aims, extent, and cost of the scheme being explained, and particularly the water rate to be charged. If over 50 per cent. of the owners or occupiers approve and sign binding agreements to pay the annual charges the Government may proceed with the work, and may under the ordinary processes of the Public Works Act resume the land of the owners who will not support the scheme, and sell or lease the same to others. This, if thoroughly carried out, should be satisfactory, though no doubt the dissatisfied minority would resent the coercion, but they would soon be forgotten if the scheme proved thoroughly successful. Instances have been known in Victoria where at the inception of a scheme settlers have sold out at a loss and left in disgust, only to return when the efforts of their neighbours had vastly enhanced values, and buy in again at perhaps twice what they sold for. This was particularly the case at Mildura.

Probably the best method would be as follows: Having decided favourably all the other counts as above, then delimit the area to be served by a scheme (all the boundaries of its subdivisions will be unsuitable). Then purchase either by a mutually satisfactory arrangement or, if necessary, by compulsory resumption, as in the case of

lands for settlement. Then carry out the work of distributing the water by the best method, having regard to the contours and natural features. Then re-subdivide the area into farms of suitable size and shape for economical irrigation and working; and, finally, throw the whole open for selection as a ready improved or partially improved settlement. The construction of the necessary roads would, of course, go on simultaneously with the races.

4. SUITABILITY OF CLIMATE.

This is a matter involving more than just a question of rainfall per annum. The hours of sunshine are important. The distribution of the available rainfall is most important, as is also the prevalence of frosts and their distribution. This is affected by the height above sea-level and general position. The maximum summer and minimum winter temperatures affect the classes of crop which can be grown and the methods of feeding which must be adopted for live-stock. Wind is another important factor. It has a threefold effect. It directly affects the crop by breaking it down or prematurely threshing it, and indirectly by drying up the moisture in the soil, whether the same be natural or present as a result of irrigation. It also tends to blow away the best of the soil, and perhaps the seed, just at a critical time. Wind is also probably the greatest factor in evaporation. In New Zealand there is practically no locality where information concerning the greater part of the above points is not available either partially or entirely, in varying degrees of exactitude, except as regards evaporation, concerning which I know of no available data.

5. QUANTITY OF WATER REQUIRED.

This question is the one on which there is least information in New Zealand. Farmers have not yet realized the essential nature of this information, and for a very good reason. Each one who has an irrigation right has obtained it under a grant from the Goldfields Warden, either directly or indirectly, and has, generally speaking, got all he could. In many cases rights have been granted for far more water than could possibly be used on the land available, and also for far more water than actually exists in the source of supply. Thus, it is not in the interests of the holder of a right to furnish any information which would tend to prove that he had more water than he had any need for. It might lead to pressure being brought to bear to have some of it passed on to some one else. Quite recently Mr. O. L. Waller, Professor of Civil Engineering of the State College of Washington, U.S.A., wrote, "It is important that an economical use of water be fixed by our Courts; but to bring it about it will be

necessary in all cases involving rights to the use of water to introduce expert testimony showing the water requirements of the land for which the duty is to be fixed. This could be brought about by making the State (representing the public) a party to all such litigation, and making it the duty of the Attorney-General, or his representative, to protect the rights of the public, and to introduce testimony that would assist in establishing an economical duty."

I may explain here that the "duty" of water is an expression by which we denote the area which a certain flow of water will irrigate properly in a given time, or, alternatively, what amount of water, measured either as a depth over an area, or as cubic contents, or as a time-rate, will irrigate a certain area. Thus, in two schemes now in progress in New Zealand it has been fixed that the duty of water shall be as follows: A cubic foot per second flowing continuously for 150 days will irrigate 200 acres or 150 acres respectively.

This subject of the duty of water is one of the most burning questions in irrigation, and, unfortunately, in New Zealand it is one on which our information is far from complete. What is required is several experimental farms on which various crops suitable for semi-arid climates could be experimented with, and on which definite figures could be obtained as to the returns which might be expected from different classes of farming; and also—of most importance under this head—how much water is actually needed for various crops on different soils. Such farms would be an object-lesson to surrounding farmers. There are settlers now irrigating who, if properly approached and instructed, I am sure would take the necessary measurements and notes to enable very valuable data to be collected. Others again, for reasons above stated, would not assist. The best results would be obtained from those who have to buy their water and can only get small quantities. They naturally do not waste it knowingly. A very pointed example of this may be cited. In Apulia, where water sometimes costs 1½d. per 1,000 gallons, a farmer will spend in water up to £2 per acre for a supply less than half that proposed to be supplied in Ida Valley, Central Otago (and with this will make a profit of about £1 10s. per acre); while in Lombardy, where water is cheap—about one-twentieth part of the other price—the farmers use ten times as much water. I say "use," but they really waste a great deal.

Within certain limits, as water is increased the crop increases, but after reaching a critical point the application of more water actually results in less crop; and, further, long before this stage is reached the increase in crop is less than the increase in cost of water, and the increased yield is actually obtained at a financial loss. It is points like these which must be stressed continually. A prominent Los

Angeles engineer at the Panama Exposition gave an example of over-irrigation—it might be called a shocking example—relating how a farmer had a lucerne patch on which he was in the habit of applying $5\frac{1}{2}$ ft. of water before cutting. Mr. Lee, the engineer referred to, arranged for a demonstration, and divided the patch into two portions; *the first he treated as before, but to the other he applied 6 in. before each cutting, and obtained twice what the farmer did.*

Everywhere in America the folly of the old lavish granting of water-rights is being felt, and the State is continually endeavouring to educate the farmers and the public generally into the economical use of water. A wonderful example of progressive economy is that in connection with the San Joaquin and King's River scheme, the progress being as follows: 1907, 2·44 acre-feet per acre; 1908, 1·49 acre-feet per acre; 1909, 1·44 acre-feet per acre. This was due to a change in the method of charging. In the first case the charge was at per acre for sufficient water. In 1908 the system of charging for water actually used came into force, and the consumption almost immediately dropped nearly half. Although of late years the old system of charging has been revived on this area the demand still remains at the lower figure, showing the educative effect of the few years on the other system. *Over-irrigation has a very emphatic way of making itself felt by raising the ground-water level (possibly of land quite outside the area being irrigated) until the land is quite waterlogged.* In the United States it was estimated in 1914 that 15,000,000 acres were irrigated, while as a result of this irrigation easily over 1,000,000 acres had become too wet for profitable cultivation.

In Canada the law fixes the duty of water at 2 acre-feet per season, which is 33 per cent. greater than our Ida Valley scheme, and the same as is proposed for the Manuherikia and the Cromwell schemes. It is undesirable that such a matter should be fixed by law, as no two localities are exactly alike. Mr. Peters, the Commissioner of Irrigation in Alberta, whom I had the pleasure of meeting at Calgary, stated that as far as experience had gone in his district it indicated forcibly that the Canadian legal duty just mentioned is more than ample.

While public interest is probably to secure the greatest irrigated acreage consistent with reasonable efficiency, individual interest will aim at the maximum return per acre. The Government's duty will consist in seeing fair play between these opposing ideals.

6. AVAILABILITY OF WATER.

This question involves, first, a general examination of all possible sources of supply, from which one of two possibilities will no doubt

stand out and be marked for closer inquiry. These must be traced, both on the ground and (in New Zealand) in the register of the Warden's Court, to see whether all the water has already been taken up. If it is, the existing rights must be bought, or the rights forfeited if not fully used, or the scheme abandoned if no other reasonable source of supply is available. Estimates must be made of the cost of leading the water from each promising source, so that the most favourable may be determined.

Assuming the water is available, the next question is as to its sufficiency, either with or without storage. The rainfall within the drainage area at as many points as possible must be obtained. If no record exists, then the probable precipitation may be deduced inferentially from records of the nearest recording-station and others similarly situated.

After rainfall comes the area of watershed. From records extending over nearly ten years (which were summarized and dealt with by me in a paper read the year before last to the society) very valuable information has been gained in regard to certain areas, but further similar records are wanted elsewhere in New Zealand. Canada especially has given this subject great attention, and has a regular Government Department which attends solely to stream-measurement and the deductions therefrom. The actual flow in the river which has been tentatively selected as the source of supply must be measured, if possible, at the period of the year when it may reasonably be supposed that it is lowest, also at about mean height and at one or two periods of high water. From these determinations a curve can be deduced which will give the discharge at any height within working-limits, and if a gauge is established at some convenient spot adjacent to the measuring-point and point of intake for the irrigating canal and this gauge is read regularly, then the actual quantity discharged for the period of the observations can be known—the longer the record the more accurate the results.

The question of pumping either the whole supply at some point, in preference to bringing it in by gravity, or by small units from subterranean supplies must also be investigated, and this may require investigation of costs of possible sources of power, either available or to be developed.

7. SITES FOR WATER-STORAGE.

While the factor of water-availability is being dealt with, sites for dams must be searched for, and when found they must be surveyed and the country above them contoured to find out how much water will be impounded by dams of various heights, in order that the most economical height may be determined. It must also

be ascertained by this means whether the land to be covered by the reservoir is private property, or if it can be covered with impunity as well as water, and, if not, what it will cost to purchase. A preliminary calculation, based on the rainfall statistics and the drainage area, will give figures on which to base the reservoir capacity required.

I think it may be said that in Central Otago the rainfall is so scanty and the irrigable land so widespread that every place where a reservoir can be constructed at reasonable cost will be utilized eventually. In order that some conception may be formed of the order of magnitude of reservoirs necessary, I may cite a few instances. For the Ida Valley scheme three dams are proposed, the largest one of which has been constructed with a capacity of 1,600 million cubic feet. For the irrigation of the Maniototo Plain (or, rather, a portion of it) a dam impounding 10,000 million cubic feet is proposed. In Sardinia there is now under construction a dam 180 ft. high to impound 12,300 million cubic feet, while three others in Italy to store each between 12,000 and 14,000 million cubic feet are shortly to be proceeded with. I mention these reservoirs because of the similarity of the countries in question to New Zealand in area and climate. In comparison with those consider the Burrenjuck in New South Wales, 33,000 million cubic feet; the Pathfinder in the United States of America, 43,000 million cubic feet; the Assuan in Egypt, 47,000 million cubic feet. Of course, the areas to be irrigated by these latter are similarly enormous.

From the foregoing it will be seen that in Otago the question is, generally, What is the largest reservoir that can be formed by a dam of practicable proportions? Thus the Manorburn dam could have been constructed to hold 160 million cubic feet for £1,600 = £10 per million cubic feet, but was built the maximum feasible at a cost of £40,000 for 1,600 million cubic feet, being £25 per million cubic feet. And yet this was better engineering than the smaller and cheaper scheme would have been.

In addition to investigating the actual capacity of the reservoir-site, a determination of its geological character is an important point. It should be of a reasonably impervious character, or, rather, it should give promise of being impervious, for until it is actually filled one cannot be sure. The geological data of the actual dam-site must be investigated with all the thoroughness bestowed on the foundation of any large work, particularly a dam, which by its failure would endanger life and property below. Apart altogether from this aspect there is the need for continuity of service, for any irregularity in the supply of water, once irrigation is in full swing, might mean the loss of all the crops. The labour, seed, &c., represented by a crop of cereals may be said to be in the region of £5 per acre.

Therefore if 10,000 acres depended on a certain reservoir and the water failed at a critical time the loss would be nearly £50,000.

Another point is the relationship of the reservoir capacity to the drainage area. I know of several ideal sites where water could be impounded at a very low rate per million cubic feet, but there is nothing to fill them with. Again, the site of the reservoir may be valuable land which would grow more than the irrigated land watered by the stored water; but this would be an extreme case unlikely to occur, at any rate, in New Zealand, where all suitable dam-sites yet investigated have been back in the mountains.

8. COST AND CHARGES.

The eighth consideration is one which gives cause for an immense amount of work. We must assume that preliminary investigation has shown that a scheme has a reasonable chance of being commercially successful. The whole of the works necessary for the storage, transmission, and distribution of the water must be surveyed for, designed, and their cost estimated in detail, so that the controlling authority may go to the settlers, prospective or actual, with figures which will offer the water at the lowest possible price, and yet will not land the promoters in a loss eventually. Though this can be done after works of a similar character have been built, and during normal times, it is difficult when no similar work has been done in the locality or even in the country. Still less can cost be gauged when world-convulsing disturbances occur, such as we are now passing through. The price which can be paid by farmers for water depends largely on the crops that can be grown on the land, which is bound up in the first and ninth factors enumerated. For instance, charges of 6s. per acre are by many considered high in Canada, where the possible crops are limited and the growing-period short, while, with no better soil, growers of oranges, &c., in California pay up to £2 10s. per acre. In Italy water is so precious in parts that it is sold by th 1,000 gallons, sometimes at prices as high as 1s. 6d. per 1,000. I Spain, under some modern systems, the charge increases year by yea until in 1919 it will be approximately 2s. 6d. per acre; but th is intended only to cover working-expenses and maintenance. Th Government is evidently satisfied with the returns from the increase value of the irrigated district to compensate for the original appro priation made for the construction of the works. In older systen erected by private companies the charges are higher, and in at lea one area the charge is a ninth part of the value of the crop raise The average works out at 10s. to 12s. per acre per annum.

If we assume that before irrigation one sheep to 2 acres ca be grazed, and that the revenue from a sheep is £1, then the lan

returns 10s. per acre. If irrigated properly it can probably carry three sheep to the acre, but, not to be too optimistic, let us say two sheep, and we then have £2 per acre. Let the cost of distributing the water be taken at 10s. per acre per year (this is above the real cost), and let the extra cost for labour on the crop be 10s. per acre, then the amount which could be spent in water is £1 per acre per annum; and if the farmer got his water for 10s. he would make a handsome profit—twice what he did without water. If lucerne be grown, higher values of produce result and higher prices can be paid. Last year lucerne hay in Victoria fetched £10 to £16 per ton, and £6 to £8 is quite usual. With 3 tons to the acre, which is not unusual, very large values may be realized.

It is a great mistake to introduce temporary work into irrigation projects. They are entirely different from mining ventures, and are more permanent than even city water-supplies. The latter are always becoming obsolete as population increases, and must be replaced by larger works; but in irrigation projects the maximum water available is usually provided for, and when this is done there should be no change as long as human life retains its present characteristics. How well the older countries understood this can be gathered from the fact that many Roman irrigation-works are still in use, and in Cyrenaica, in Tripoli, the Italians are now restoring to use the aqueducts and storage-basins erected by the ancient Greeks. Though some of the earlier schemes in America were carried out in what we generally consider characteristic Yankee fashion, these were mostly done by private companies whose primary object was to sell land and water-rights at high prices, and then "quit," as they express it. The enormous works of the Canadian-Pacific Railway Company and the United States Reclamation Service are built for posterity, and the maintenance charges will be a minimum. The tendency nowadays is for prices of everything to soar, so that when considering whether to build, for instance, in wood or concrete, account must be taken of the fact that when the present wood is rotten the reconstruction must be made with material much more expensive. But this is not confined to irrigation ventures.

To get down to bed-rock, the promoter wants as high a price as he can get for the water, while the farmer wants it for nothing; and it is the duty of the investigating engineer to see that his principal gets a fair return for his money, and at the same time that he (the engineer) does not advise the construction of works which will necessitate a charge that it would be beyond the capacity of the land to carry.

9. MARKETS FOR IRRIGATION-PRODUCE.

This question is not a difficult one to answer at present, for there is a market (thanks to refrigeration, as regards perishable products) for practically every staple that can be grown in New Zealand. But one must go further and look into the question of what is the most valuable and at the same time most suitable crop which the land will grow, and see if a market for that crop exists. For instance, it is unnecessary to seek far to know that if pasture is irrigated and sheep fattened there would be a market, but it would be a very different matter if pumpkins were the general crop. Similarly, in Australia lucerne hay commands a practically unlimited market at prices already given, but in New Zealand the dry country is so much more limited in area that if a large number of farmers specialized in this crop there would soon be a glut in the market. As irrigation becomes more definitely established the farmers on less fortunate lands will realize that they can carry more stock in summer on their own produce and tide over the winter shortage by lucerne hay from irrigated lands. Then up will go the prices for fodder, and more land will come under the plough wherever water is available.

At present fodder is railed to Central Otago from the Taieri Plain, but soon the land there will be too valuable for such crops, and then the fodder from irrigated lands will find its rightful place. The advent of the motor-vehicle has spoiled the market for oats and hay until the feeding of sheep and cattle, as indicated, is developed. This brings me to the tenth head.

10. SUITABLE SETTLERS FOR IRRIGATED LANDS.

Can suitable experienced settlers be found? This is probably one of the greatest difficulties which will have to be overcome in New Zealand, where schools for the training of irrigators are very limited. I do not now refer to institutions for the inculcation of the principles of irrigation, but to real irrigation farms, where men have to irrigate properly to make a living. To quote Professor Newell: "It is beginning to be appreciated as never before that the success of any irrigation enterprise lies in the character, education, and skill of the men who use the water, more than in the irrigation-works themselves. Not long ago, when most of the larger irrigation systems were being projected, it was believed generally and asserted confidently that it was necessary only to build the reservoir and main canals of a project and then let the settlers do the rest. It was assumed that competent farmers would be attracted to the irrigable lands; and that (like the pioneers in irrigation development) they would unite in their own ways, adapt themselves to the conditions existing, build the needed distribution systems, initiate methods of irrigation, and advance

rapidly toward success in raising and marketing crops. It was recognized that co-operation and concerted work must be undertaken; but it was believed that these matters could be left to the characteristic Western spirit, which relies upon individual ability and enterprise overcoming all natural obstacles. This belief is now known to have been a mistaken one, and the results have been largely disastrous. Great irrigation systems have been built, but a large part of the land which might be irrigated from them remains unutilized, because the early settlers on the lands did not make such financial successes as to attract additional settlers. In short, they did not find that irrigation pays, or at least that it pays sufficiently well for them to urge their relatives and friends to do as they did. The reasons for the delay in settling irrigation problems have been many, but the one fundamental cause of slow irrigation development is a neglect in the past of the human element. Now, irrigation-works can be extended only because of demonstrated successes under the irrigation systems already built, and such demonstrations can be made only when the lands already provided with irrigation are being tilled profitably."

These remarks exactly express the idea that a score or so of really successful irrigation farmers will do more to promote the success of subsequent projects than hours or weeks of lecturing and reams of printed matter. The men for the irrigated lands are the men from the dry belt—preferably New Zealand's dry belt; and the aim of all who have the welfare of Otago and Canterbury at heart should be to provide inducements for their own growing lads to stay there, and not allow them to drift to the North Island as in the past. Towards this object I know of nothing which presents anything like the attractive features that a vigorous irrigation policy does.

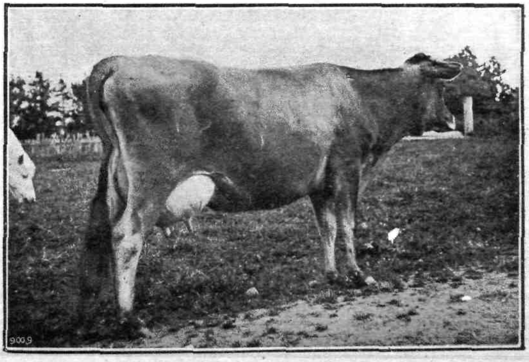
CONCLUSION.

From the foregoing will be realized something of what a complex subject irrigation is, and how necessary is thorough investigation along many lines. As illustration of this I will give a translation of a report by a Spanish engineer on a large project which is practically a failure for want of proper consideration of the foregoing points. He says, "The Urgel Canal lacks, point by point, all those elements that go to make irrigation in northern Italy so successful. The project was conceived and work begun before surveys and estimates had been completed; without thought of the indispensable supplementary structures; without plans; without knowing the irrigable area or character of the land and the inherent difficulties that encompass a project of such magnitude. There is lacking storage of water land the summer months and regulation of the flow at all times. The

people under the project lack the proper incentive to work, so necessary in an irrigated country. There are lacking highways of communication, well-to-do agriculturists, instruction in the technique of irrigated farming, institutions of rural credits, and a proper division of proprietorship. They have staked their all on the virtues of the water alone. Is it any wonder that failure should have followed such lack of foresight, such negligence ?"

New Zealand must endeavour to avoid such errors as these, in order that the schemes that are developed may have a reasonable chance of success. After examining the irrigated lands of many parts of both the Old and New Worlds I hold that we possess many tracts of land admirably situated for irrigation, capable of being supplied with water at such a price as the land will easily support, a climate superior to that of many localities abroad where already irrigation is a settled and successful industry, an unlimited market, and a population which every patriotic New-Zealander will be prepared to maintain is as enterprising and capable as that of any other land. Viewing this combination of favourable factors, it must be apparent to all that irrigation in New Zealand has a great future before it.

CERTIFICATE-OF-RECORD COWS.



WAIPIKO MYRTLE.

A daughter of Eminent's Fontaine, bred and owned by Mr. C. G. C. Dermer, Cheltenham. C.O.R. at 2 years 339 days: 562·49 lb. butter-fat.

POULTRY-FEEDING TESTS.

SECOND YEAR'S LEADING PEN FED WITHOUT WHEAT OR POLLARD.

F. C. BROWN, Chief Poultry Instructor.

IT will be recalled that at the end of 1914 and in the first half of 1915, owing to the effect of the war and the shortage of supplies, the price of wheat soared to such an abnormal level that its use for the time being was practically prohibited as a poultry-food. With the object of finding a substitute for wheat, which until then had been generally considered as an indispensable item of a fowl's diet, the Department, in May, 1915, instituted feeding-tests at its Milton Poultry-station. The object of these tests was not to aim at high egg-records or high profits over the cost of production, but to ascertain as far as possible what results could be obtained by the elimination of wheat from the ration. The offals of wheat, pollard and bran, were included in the dietary, as it was considered that so long as wheat was milled in New Zealand its by-products would be available for poultry-food. It is, however, gratifying to note that not only were good egg-yields obtained from the non-wheat-fed birds, but also that a good profit was shown over cost of production.

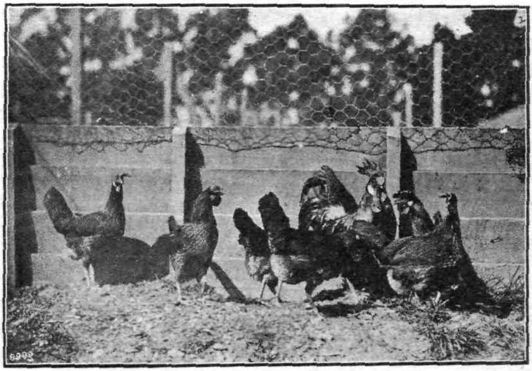
THE FIRST YEAR'S TESTS.

Table I presented herewith gives details of the first year's test, which commenced on 1st May, 1915, and concluded on 28th April, 1916. It will be seen that four pens took part, two of White Leghorns and two of Brown Leghorns (six birds in each pen), one pen of each breed having wheat in the ration and the others none. The birds were of the same age and strain, and were selected as evenly as possible on type points indicative of constitution and laying-power. In duplicating the experiment it was considered that by using one pen of each breed of the same age and strain, and supplying a different ration respectively, the results would be more conclusive than would have been the case if only single pens of one breed were used.

It will be seen that for the twelvemonth the non-wheat-fed birds were only beaten by nineteen eggs and the small sum of 6s. 3d. profit over cost of production. It is well to mention, however, that the price of wheat considerably declined shortly after the commencement

of the experiment, thus reducing to some extent its value as a comparison so far as the profit on the non-wheat birds was concerned. Had wheat maintained its previous high level of value the pens without wheat would undoubtedly have shown a better profit than the wheat-fed birds.

It was originally intended that the test should extend for twelve months only. When, however, the remarkably even returns produced by the several pens and the healthy state in which the birds finished up their year's work was considered, it was decided to continue the experiment (on slightly extended lines) for another year, the



THE SECOND YEAR'S LEADING PEN, NO. 4, BROWN LEGHORNS.

variation being chiefly concerned with ascertaining to what extent lucerne-meal would take the place of pollard. The results demonstrated in this further test have exceeded expectations.

THE SECOND SERIES.

Table II gives particulars of the second series of the experiment, which commenced on 1st May, 1916, and concluded on 30th April last. It will be noted that pens 1 and 3 received the same dietary as last year, while in the case of pens 2 and 4 the only alteration made in the rations was that lucerne-meal was substituted for pollard. It is interesting to observe that in the leading pen, No. 4, both pollard and wheat were entirely eliminated from the ration. Last year this

pen (Brown Leghorns) finished second with 1,449 eggs, while pen 2 (also Brown Leghorns) produced 1,463 eggs. The high average shown by the birds of pen 4 of over two hundred eggs each in their second year not only indicates the strong staying-power possessed by them, but also points to the high value of the food consumed which enabled them to produce this fine egg-yield.

The results from pen 4 are all the more significant when it is considered that the birds laid 2,660 eggs for the two years, or an average of over 443 per bird, without wheat being included in the ration throughout the period, and for the last year without pollard also. Even under public-competition rations this average would be considered good, especially the return during the second year. It is also interesting to note that pen 2, which came first with 1,463 eggs last year and second with 1,079 this year (an average of 423 per bird for the two years), received wheat throughout, but no pollard in the second year.

The results registered by pens 1 and 3 in the second test are also interesting. These pens received the same rations respectively as in the first test, when pen 1 laid 1,438 eggs, as against 1,443 by pen 3. In the second series of the test pen 3 produced 1,042 eggs, as compared with 956 by pen 1. Thus, for the two years, pen 3, which had no wheat throughout, gave an average per bird of 412 eggs, as against the wheat-fed birds in pen 1 with an average of 399.

THE BIRDS AND THE CONDITIONS.

While results from these experiments are extremely satisfactory, it must be recognized that the birds which took part in them were of high-type laying-strains, and that there was nothing wanting in the matter of management. The birds were well housed and fed regularly, while strict attention was paid to cleanliness, and also to the little details essential to profitable poultry-keeping. The healthy appearance the birds maintained throughout the two years was commonly commented upon by visitors to the station. This form indicated that the birds possessed the desired constitutional vigour, and the healthy conditions under which they were kept enabled them to maintain it. It may also be mentioned that the class of food supplied was of the very best quality, special care being taken in this respect that the oats used were of short, good plump quality. The same may be said of both the lucerne chaff and meal supplied. In each case these were of excellent quality, and a large portion was both grown and made into chaff or meal, as the case might be, at the station itself.

POULTRY-FEEDING TESTS.—MILTON POULTRY-STATION.

No. of Pen, and Breed.	Number of Eggs produced.	Average Number of Eggs per Bird.	Value of Eggs.	Average Value of Eggs per Bird.	Food consumed.	Cost of Food.	Profit over Cost of Food.	Cost of Feeding per Bird.	Profit per Bird over Cost of Food.
I. First Series. Period 1st May, 1915, to 28th April, 1916.									
			£ s. d.	£ s. d.	lb.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
(1.) 6 White Leghorns ..	1,438	239	8 18 7	1 9 9	Mash: Pollard .. 275; Bran .. 103; Maize-meal .. 93; Meat-and-bone meal 86 Wheat 426	4 7 3	13 11 8	0 7 3	1 2 6
(2.) 6 Brown Leghorns ..	1,463	243	9 0 4	1 10 0				0 7 3	1 2 9
	2,901		17 18 11						
(3.) 6 White Leghorns ..	1,433	238	8 16 5	1 9 4	Mash: Pollard .. 240; Bran .. 91; Maize-meal .. 95; Meat-and-bone meal 85 Lucerne-chaff .. 173 Oats 406	4 11 8	13 5 4	0 7 7	1 1 9
(4.) 6 Brown Leghorns ..	1,449	241	9 0 7	1 10 1				0 7 7	1 2 6
	2,882		17 17 0						
II. Second Series. Period 1st May, 1916, to 30th April, 1917.									
(1.) 6 White Leghorns ..	956	159	6 2 8	1 0 5	Mash: Pollard .. 133; Bran .. 43; Maize-meal .. 40; Meat-and-bone meal 17 Meat-and-bone meal (fed separately) .. 25 Wheat 229	2 2 0	4 0 8	0 7 0	0 13 5
(2.) 6 Brown Leghorns ..	1,079	179	7 0 7	1 3 5	Mash: Lucerne-meal .. 104; Bran .. 43; Maize-meal .. 36; Crushed wheat .. 71; Meat-and-bone meal 20 Meat-and-bone meal (fed separately) .. 23 Wheat 189	2 2 5	4 18 2	0 7 1	0 16 4
(3.) 6 White Leghorns ..	1,042	173	6 12 2	1 2 0	Mash: Pollard .. 112; Bran .. 38; Maize-meal .. 40; Lucerne-chaff .. 82; Meat-and-bone meal 21 Meat-and-bone meal (fed separately) .. 22 Oats 202	2 2 6	4 9 8	0 7 1	0 14 11
(4.) 6 Brown Leghorns ..	1,211	201	7 13 10	1 5 7	Mash: Lucerne-meal .. 110; Bran .. 40; Maize-meal .. 36; Crushed oats .. 77; Meat-and-bone meal 21 Meat-and-bone meal (fed separately) .. 27 102	2 3 9	5 10 1	0 7 3	0 18 4

OTHER DETAILS.

In pens 1, 2, and 4 the morning mash was moistened with hot water. In pen 3 the lucerne-chaff was steamed overnight. The moisture contained therein, together with any liquid that was not taken up, usually provided sufficient to make the mixture to a desired consistency. In addition to the meat-meal fed in the morning mash, this material was provided in a separate receptacle in each pen, and left always before the birds to pick at, thereby giving them an opportunity of balancing their own ration. The evening meal, which consisted of whole grains, was usually fed in litter in order to induce the birds to exercise. At each meal the birds were given as much as they could eat without waste. Except during the winter months, when turnips were fed, the grass in the runs provided the necessary green food. Gravel, grit, crushed oyster-shell, charcoal, and also clean water were always left before the birds.

During the second year one bird each died in pens 2 and 4. These were replaced with others of the same age and strain.

It should be noted that the cost of food consumed and the values credited for eggs, as recorded in the accompanying tables, are estimated at the average wholesale rates for the Dominion during the period covered by the test.

CONCLUSIONS.

From the two years' tests the following conclusions appear to be justified:—

That wheat, and even pollard, are not indispensable in the dietary of the heavy layer when oats and lucerne-meal are substituted.

That hens in their second year, with both wheat and pollard eliminated from the ration, can produce a profitable number of eggs.

That meat-and-bone meal makes a good substitute for boiled meat.

That the quantity of meat-meal eaten is largely influenced by the number of eggs laid. This is indicated by the quantity of meat-meal consumed by pen 4 (see table).

That a large quantity of meat-meal can be consumed by heavy-laying stock without injurious effects, such as ovarian troubles, provided the meal is chiefly supplied in a separate hopper and kept always before the birds for them to pick at.

That a good laying-strain of Brown Leghorns is a profitable breed to keep for egg-production.

That lucerne-meal is preferable to the chaffed-hay form of lucerne as an egg-producer, and also as a labour-saver, steaming overnight being unnecessary

NOXIOUS WEEDS AND THEIR CONTROL.

CALIFORNIAN THISTLE.

A. H. COCKAYNE, Biologist.

IN the last issue of the *Journal* the inquiry undertaken by the Board of Agriculture regarding noxious weeds in New Zealand was discussed from its wider aspects. The following data concerning Californian thistle form the first of a series of notes on the various weeds comprised in the replies to the circulars issued by the Board. The matter is gathered from a careful study of the circulars combined with my own knowledge of the subject.

In Southland and South Otago Californian thistle is ranked as the most serious weed, but there appears to be a general consensus of opinion that on grass land it is not particularly serious. The value of cutting is difficult to ascertain, some declaring such procedure valueless, while others assert that patches weaken under the process. It is noteworthy that many report laying down in permanent pasture as the most satisfactory method of dealing with thistly land. On arable land the general practice is to plough in autumn and work the ground till into the New Year, then sowing down with turnips or swedes in ridges, and continuing with a horse-hoe until the early autumn. This is followed by spring ploughing, early summer cultivation, and a second crop of turnips, followed perhaps in the next year with rape and grass, a liberal seeding of clover being included in the mixture.

Quite the most significant feature of thistle-control in Southland is the attempt to introduce conditions unfavourable to the development of the weed during its growth-period and at the same time fully utilize the land during the long period the thistle is dormant. The introduction of a rapidly maturing smothering catch-crop to replace the summer fallow is worthy of consideration. A modification of the above method is to plough in December and work for a whole year before sowing turnips. The main point generally emphasized is to sow as late as possible in the season. The important period of cultivation is from the middle of December to the middle of January. No mention is made of the value of lucerne in controlling thistle, and it is dubious whether this practice, applicable to drier districts, would be of much value.

In Central and North Otago Californian thistle is ranked as the most serious weed, mainly on account of its bad reputation. It is remarkable that *lucerne-growing is not generally adopted to control thistle on badly affected land in this district.*

In Canterbury Californian thistle ranks second amongst noxious weeds, pride of place being taken by one or other of the couch-grasses. Control in Canterbury is essentially different to that practised in Southland. The thistle apparently exists mainly in comparatively small patches; *affected ground is virtually quarantined*, and a long continuous cultivated fallow, extending sometimes over years, is adopted. Salting, up to the rate of 24 tons per acre, is also regularly recommended, and apparently carried out. The vigorous cutting of thistle on all waste ground is urgently demanded.

In the Kaikoura-Blenheim district lucerne-growing is universally recommended for control on ploughable land, and this is apparently perfectly successful both on mown and grazed lucerne areas.

In Nelson Californian thistle falls to fifth place as a noxious weed.

Coming to the North Island, a great diversity of opinion is held as to the harmfulness of Californian thistle. Many report that cutting is of no value, and that proper stock-management, subdivision, and attention to pastures by top-dressing, &c., is the best course to take. Others, again, report that cutting is the only possible successful method. The variation in opinion is so great that the matter requires the most careful examination. The replies indicate that control-measures must vary in accordance with the type and character of the ground. I have divided the latter into five grades, as below.

SOME TENTATIVE SUGGESTIONS REGARDING CONTROL.

On Cropping-land.—On such land where Californian thistle exists in small patches it may be advisable to adopt the Canterbury system of semi-quarantining the land, and adopting very expensive methods of control by continuous cultivated fallow, heavy salting, &c., the expenses of such work being debited to the working of the whole farm and looked upon as an insurance policy against further infection. This system, however, is impossible where the patches are at all numerous and large, and under such conditions a system such as that adopted in Southland should be carried out—namely, short fallows, the use of winter-growing forage crops, smothering summer forage crops, together with grain crops at intervals, and the liberal employment of temporary pastures consisting largely of clover cut for hay, perhaps twice in the season. Lucerne-growing on thistle land should never be overlooked, but is advocated only in localities where lucerne is known to thrive. In Central and North Otago, for instance, the

use of lucerne should be largely encouraged on thistly land, but in many parts of South Otago and Southland such a procedure would — at least with our present knowledge — be economically unsound. Soiling-crops, especially those that can be cut several times during the summer, are to be highly recommended.

In many localities the repression of thistle should be followed by the laying-down of fairly long grass-leas, and investigations on this point are required. The restriction of fallowing and its replacement by catch-cropping also is in crying need of study.

On Grass Land capable of being ploughed.—By such land is meant that fit for arable farming, but which the farmer would prefer to remain in permanent grass land. Such land is often of good quality, and soil-amendments — especially by drainage and top-dressing — by encouraging a thickening of the sole during the dormant period of the thistle, would often do far more good than cutting. Mowing, however, should be done wherever such a procedure is payable, and careful attention to stocking, especially heavy stocking during the flowering and seeding stages, is required. The good effect of rubbing-posts in thistle-patches is an indication of the value of trampling, and there appears little doubt that the trampling method of control could be considerably developed, especially by growing special crops and feeding them out on thistle-patches. Where methods such as the above are not successful, then cultivation methods as suggested for cropping-land would have to be undertaken, and, finally, when the weed was sufficiently weakened, the land laid down again into permanent grass.

On Grass Land temporarily incapable of being ploughed.—Such land may either be level (potential cropping-land) or undulating (potential turnip and forage-crop country, and capable of being reseeded to pasture); but the limiting factor rendering it incapable of immediate cultivation where such a procedure would be advisable is the presence of logs and stumps. Efforts directed towards logging up the land, and a certain amount of stumping of the better-class land, must precede any definite efforts towards Californian-thistle repression. Small areas should, however, be cleaned up annually, subdivision carried out so that areas can be thoroughly stocked, especially with cattle, during the flowering and seeding stages, and plenty of attention given to top-dressing. As soon as the land is in a sufficiently clean condition for ploughing the level lands should be cropped with smothering forage crops and those crops that mature and are fed off during the dormant season of the thistle.

Lucerne-growing should always be in mind in dealing with level thistly land as soon as it is capable of being ploughed, taking off first

either a turnip or rape crop, in the latter case sowing late and feeding off finally in the early spring and laying down lucerne in the summer. On the hillier land, after logging, &c., where the pasture is poor and needs renewing, careful attention toward sowing-down again into permanent pasture should be given. In many cases it is probable that some system of annual forage-plant cropping, combined with temporary pastures largely composed of Italian rye-grass and cow-grass, may have to precede any final resowing of a permanent nature. On level land temporary pasture fed on during autumn and winter and shut up for a double crop of hay—first-cut rye-grass and second-cut red-clover hay—should prove very useful. Such temporary pastures may in many localities last two years, and in the autumn of the second season be heavily seeded with a cocksfoot mixture, a light disking and harrowing being perhaps a sufficient preparation for a seed-bed in certain localities. Many modifications naturally suggest themselves, but all the operations preceding the final sowing must pay for themselves and at the same time be directed towards the weakening of the thistle by either fallowing, mowing, or very heavily stocking the thistle areas during the main period of growth (November to February). The general clearing up of land of this description in order to facilitate ploughing is, however, the first consideration.

On Grass Land permanently incapable of being ploughed.—On such land no direct mechanical methods of control should be attempted. When a farm consists solely of such country very little can be done except by subdivision and heavy stocking at definite periods. The capabilities of top-dressing should never be lost sight of, especially to secure good autumn, winter, and spring growth of grass during the dormant period of the thistle. This will thicken up the sole, probably the most important of all means of indirect control of weeds. The burning and surface-sowing of thick patches of thistles in the autumn with vigorous-growing grasses and clovers should be studied in this connection.

On Grass Land of extremely poor Carrying-capacity.—Here no control of any sort is advisable, as thistles on such land, provided they will continue to grow, do more good than harm, and may finally lead to the production of quite fair grass land.

The presence of lichen on orchard-trees is evidence of neglect to spray properly. It is advisable to scrape the larger tufts off, a piece of hoop-iron answering well for the purpose. After the large tufts are removed spray thoroughly while the trees are dormant with lime-sulphur, 1 in 15; or caustic soda, 6 lb. to 10 lb., in 50 gallons of water.

POTATO-GROWING FOR SMALL AREAS.

W. H. TAYLOR, Horticulturist.

PREPARATION OF THE GROUND AND MANURING.

THE time for planting early crops of potatoes depends on frost occurrences and should be as early as these will permit. For such crops deeply worked soil is essential, also good drainage, both being necessary to secure sufficient warmth in the soil. Where available, a moderate amount of stable manure should be worked in, its condition to be in accordance with the nature of the soil. For very light soil the manure should be in the state known as "fat"; for heavy land, littery; and for the medium classes of soil, in a fair state of decay, but not wet. Stable manure from corn-fed horses is considered a complete manure; no other will be required at this time, but it should not be given in excess, or it may promote a luxuriant top growth at the expense of the tubers and establish conditions favourable to blight. Failing stable manure, apply superphosphate and bonedust, 1 oz. of each per square yard, equal to 2½ cwt. per acre; sulphate of potash, ¾ oz. per square yard, equal to 1½ cwt. per acre; and nitrate of soda, 1½ oz. per square yard. With the exception of the nitrate of soda, which should not be used until growth has started, the fertilizers should be applied during the last cultivation before putting in the seed, or they may be broadcasted when planting is completed, and harrowed or scratched in with a rake.

SELECTING THE SETS.

For the earliest plantings whole sets are preferred, as there is less risk of loss from rotting, which may happen to cut sets if there is a heavy rainfall, the soil being colder than it is later on in the season. Sets are a suitable size when from half to three parts the size of an ordinary hen's egg; if larger they should be cut (but not before planting-time). Most varieties, but not all, have what is termed a rose end—that is, there is a bunch of buds at one end. Such tubers should be divided by cutting down through the middle of the rose, securing a portion of the rose for each set, as these are the best buds. Whether the seed-tubers show a distinct rose end or not, the eyes should show plump and bold.

SPROUTING THE SETS.

It is universally recognized that the sets should be sprouted before being planted. Although this is not practicable when large areas are to be planted, it is easy enough in small operations such as are now referred to. The best plan is to pack the sets close together in shallow boxes, rose end up. The boxes should be placed in a light and airy position, sheltered from rain and frost; any place that has plenty of light and air and a rainproof roof will answer. If the sets do not sprout quickly enough they can be hurried by covering them with sacks, which should be removed as soon as the sprouts start.

PREPARING THE SETS AND PLANTING.

Planting should be done before the sprouts get long; from ¼ in. to ½ in. long is best. The character of the sprouts can now be judged; those that are planted should be stout and strong; if they are thin or thread-like they will not produce a good crop; also they should be strongly set in the tuber. If they knock off easily the set is not worth planting. The sets should on no account be cut till the day before they are to be planted; if cut long before they are placed in the ground the sets shrink and the shoots are weakened, and careful experiments have proved that the weight of crop is affected. Before planting whole sets cut a small slice off each to ensure decay.

Planting small areas should be more carefully done than is possible in field culture, and better results may be expected. If the soil is inclined to be sticky a small plot should be dug over and the sets put in as the digging proceeds, stretching a line at the required distances, and planting in front of the line before turning the next spit. If the soil is kind, draw deep drills with a heart-shaped hoe, plant along the bottom of the drills and cover with a rake. The sets should be 5 in. under the surface. Before covering the sets strew some wood-ashes or soot, or both, over them, to act as a fertilizer and protection against insects and damp. Larger plantings are best done with a hoe made for the purpose, the blade 6 in. long and 3½ in. wide, with a handle 15 in. long. Either of these methods ensures the sets being placed uniformly at the proper depth and covered with thoroughly worked soil.

AFTER-CULTIVATION AND SPRAYING.

If the soil sets heavy after rain it should be loosened as soon as possible in order to assist aeration, which is highly important. When the tops are from 4 in. to 6 in. high spray with Bordeaux mixture, or its equivalent in Cooper's Bordeaux or Lawes Anti-blight. The

first moulding-up should follow immediately after spraying, as a protection against late frost.

FROST INJURIES.

When the tops are severely cut by frost nothing can be done. It often happens that a late frost will cover the tops with rime without severely injuring them, though serious loss may ensue from the scorching effects of sunshine. If the rime is removed by spraying with the coldest water obtainable before the sun shines on the plants it will prevent serious injury. Another and better plan is to sprinkle the tops with perfectly dry wood-ashes, which absorb the rime and protect the foliage while it dries. Scrim or sheets of newspaper laid over the rows late in the evening will save the plants from injury.

VARIETIES.

A knowledge of local conditions is necessary in order to make the best selection of varieties, particularly in the case of first earlies. For light soils American Early Rose is good, but is inclined to be soapy unless drainage is good. Early Puritan is fairly reliable. On heavier soil, the best varieties I have had are British Queen and Breeze's Prolific. For later use I prefer Abundance to Up-to-Date, as the former has escaped the scab disease in soil where the latter was badly affected. Dakota Red is the standard main crop in some of the warm districts of the North, but it is not good on strong, moist land, and Maori Chief appears likely to take its place. Northern Star and Gamekeeper do well on strong, deep loams. These varieties incline to make too many shoots, and this habit has discredited them to some extent, as it causes them to produce a large number of small tubers. Surplus growths should be pulled out; two or four stems are sufficient, and in that form the tubers produced are good. Up-to-Date is still the most widely grown main-crop variety.

GROWING OF PEANUTS.

THE successful growing of a plot of peanuts is reported by Mr. J. Down, Acting-Gaoler of the Waikeria Prison, South Auckland, as follows: The experiment was tried on the river-flats of the prison farm, where the soil is of a sandy nature. The ground was prepared similarly to that for potatoes. Three rows 1 chain long and 2 ft. apart were planted with a nut every 18 in. The manure used was basic super and bone, 7 lb. The nuts were planted on 15th September, 1916, and harvested on 1st May, 1917. From ½ lb. nuts planted there was a yield of 22 lb.

QUERIES REGARDING LIVE-STOCK TROUBLES.

THE usefulness of the Department is often handicapped by settlers who when asking for information in regard to trouble with their stock do not supply sufficiently full or precise information. In many cases inquirers only convey the brief information that their stock is ailing from some cause, and request a remedy; or it may be that deaths have taken place, and—on a few indefinite particulars—the cause is asked for. In order to indicate the nature of the information required before such inquiries can be satisfactorily answered, a case may be supposed where a farmer has found some calves dead in the paddock. The particulars to be supplied should include the following: Age of animals; food the animals were receiving before death (if artificial feeding, state not only the kind of feed used, but the amount used daily and how used); where the animals were running; shelter of paddock or other shelter for the animals; water-supply (whether from a running creek or stagnant water); nature of pasture in paddock (for instance, proportion of cocksfoot, &c.); state of the weather during few days prior to deaths. If the animals have been noticed to be ill before being found dead the circumstances should also be stated.

The same holds good with other classes of animals. For instance, a man will report that he has a horse going lame, that he has examined the foot and can find nothing wrong, and he asks the Department to suggest the ailment and its location. In this case also fuller particulars should be given, such as the following: Whether the horse walks sound and trots lame; whether it carries the leg stiffly at the knee or shoulder; likelihood of its having been kicked or injured in any way; length of time since it was last shod.

It would be impossible to specify all the information that it is essential to give in every case. The present object is simply to point out that people sending queries do not usually supply sufficient information to the Department or its officers to enable them to furnish a correct diagnosis of the case. This is unfair to the officers concerned, and it places them in the position of simply guessing what the trouble may be, or obliges them to send for further particulars from the inquirer, which is a waste of time to all concerned, and could have been avoided if fuller information had been forwarded at first.

It is also highly desirable that perfect frankness be observed in all communications with the Department regarding live-stock troubles. Should the farmer think in cases of mortality that death has been due to neglect, he should not hesitate to state accordingly. The pointing-out of the whole circumstances will always be appreciated.

Poultry-keeping can easily be made a profitable side-line to the farmer, who, compared with the commercial poultry-keeper, has many advantages.

WORK FOR THE COMING MONTH.

THE ORCHARD.

J. A. CAMPBELL, Assistant Director, Horticulture Division.

DURING the winter months, while the trees of the orchard are enjoying their annual rest, an opportunity of the utmost value is afforded the orchardist of carrying out various works which will not only be of the greatest benefit to the future welfare of the trees themselves but must also materially benefit the pocket of the owner. Every practical orchardist is very much alive to this fact, and there are also very few—even among those of lesser experience—engaged in the business at all who would dream of altogether neglecting their orchards during this period. There is, however, a considerable difference between neglecting an orchard altogether and taking the fullest advantage of the season.

What, then, does the work during the dormant season consist of? This depends to some extent upon the class of orchard—whether it is old or young, or whether it is a mixed orchard or one solely confined to pip or stone fruits, &c. With the average orchard, however, the work includes ploughing, pruning, spraying, manuring, attention to drainage, and shelter-hedges, and general renovation-work. On paper this list does not appear to be very great, considering the length of the season—about three months—neither is it so in reality, provided the work is taken in hand early and pushed on with vigour. The length of the season, however, is often the downfall of the orchardist; he is inclined, to use a common expression, "to hold the job too cheap," with the result that before the end of the season he finds himself with far more work than he can comfortably handle or do justice to. The latter words give the key of the whole position. It is not a matter of getting through the work only, but of getting through it and at the same time doing justice to it. Thoroughness pays in practically all work in connection with the orchard, and this applies, if anything, more particularly to the winter work.

Take spraying, for instance. An orchard during the latter part of the summer may be badly affected with mussel and San José scale, red mite, woolly aphis, &c. Weak summer sprays can be used at

that season to keep the pests in check, but the whole matter of eradication must be left to the winter, when more drastic remedies, in the shape of strong oil sprays, may be applied. But if advantage is not taken of the state of the trees to withstand a strong solution, or if such is not applied thoroughly, under a high pressure, the trouble will be sure to recur the following season. Even though the treatment be carried out in the manner indicated the trouble is likely to recur, owing to the rapidity with which such insects increase if there is sufficient coarse bark on the tree to protect them from the spray. In such cases all rough bark should be removed from the tree before spraying. This in itself provides a winter job of no small importance.

Again, take ploughing. It is quite evident that there are a large number of orchards in New Zealand that are never thoroughly ploughed. It is not sufficient to simply turn under grass and weeds. An orchard lightly ploughed in this way may be made to look well enough to the eye, but the requirements of the trees are never sufficiently provided for in this way. The plough should be let well into the ground and the hard-pan or plough-sole, formed as a result of continual light ploughing at an even depth, thoroughly broken up. Deep ploughing, of course, should not be practised close to the trees, but the furrow should be deepened considerably towards the centre of the land between the rows of trees. Fear of damage to the roots of the trees is one of the main reasons for light ploughing. This class of working induces shallow rooting, whereas deep working not only encourages the roots to penetrate more deeply, but by more perfectly aerating the soil considerably increases its fertility. The benefit to the tree as a result of deep cultivation will far more than compensate for the unavoidable loss of a few roots in bringing it about.

An equal demand for thoroughness applies to all orchard work and matters appertaining to the orchard if the greatest measure of success is to be attained.

There are several essential factors to orcharding which are of equal importance and which depend one upon the other for success. An orchard may be well cared for in every particular except shelter. A weakness of this kind would seriously affect the condition of the trees and the results that would otherwise be attained. The same would apply to an orchard well sheltered, cultivated, and pruned if spraying was indifferently attended to or the wrong ingredients used. The growth of a fruit-tree is mainly controlled by pruning, but the effect of pruning can only be relied upon to bring about a desired result so long as the orchard is otherwise attended to. For instance, hard winter pruning can generally be relied upon to produce strong

growth, but it is quite possible for fruit-trees to be so far debilitated through exposure, lack of cultivation, &c., that very little growth will follow even hard pruning. The same applies throughout. An orchard should be well sheltered, cultivated, drained, and manured. The trees should be well pruned and sprayed and kept in good heart.

Although there are a good many jobs to be done in the orchard during the dormant season, these should be done in a proper sequence if the best results are to be attained. Where such a method has been arranged and followed, the main activities for the month will consist of pruning and the application of oil sprays.

SPRAYING.

The treatment of pip- and stone-fruit trees for scale, red mite, woolly aphis, mealy bug, &c., may be carried out. For this purpose a reliable brand of oil emulsion should be used. The strength of the mixture should be based upon the strength necessary to destroy the hardiest insect found to be affecting the tree. This in the South Island appears to be red mite, while in the North Island mussel scale is the most difficult to destroy.

Oil emulsion, 1 in 10 or even stronger, is generally required in the South Island for the destruction of the eggs of the red mite. This strength will, of course, destroy all other sucking-insects that the spray comes in contact with. In the North Island, if mussel scale is present the emulsion should be used at a strength of 1 in 12, otherwise 1 in 15 will be sufficient.

ORCHARD PLANTING.

Although, generally speaking, July is not an ideal month for the planting of young trees, owing to the ground being too wet and cold, there are situations in many districts where the soil is of a more porous nature in which planting can well be gone on with at almost any time during the winter.

The first consideration in planting an orchard, after the site has been selected, is to be assured that either ample natural shelter exists or that it is artificially provided in good time to protect the young trees. This in some instances, according to the severity of the winds, may necessitate the planting of shelter one or even two years prior to the planting of the fruit-trees.

The next care is to see that the land is well worked and well drained. A few extra pounds in this direction is money well spent. An extra £10 per acre spent in working, subsoiling, and draining the land means less than 2s. per tree. That is, a tree is only required

to yield 2s. worth more of fruit during its existence than it would otherwise to pay for this extra labour, and it is pretty safe to say that it would do so the first season after coming into full bearing.

The same argument applies to the class of tree to be planted. Vigorous-growing one-year-old trees invariably give the greatest amount of satisfaction, but they should be of the best. It would be much better to insist upon our nurserymen supplying good rather than cheap trees. A good healthy tree planted under suitable conditions will thrive, and will continue to do so while it receives proper treatment, but a weakling tree is very apt to continue to be a weakling despite the best of care and attention.

The distance apart at which trees are planted varies according to locality and individual taste. There has been a tendency recently toward close planting, but it is doubtful whether this is wise for other than special circumstances. The popular distances are 18 ft. to 20 ft. For pears and the larger-growing varieties of apples a greater distance than this is preferable.

In marking out the land for planting the object should be, as far as possible, to take advantage of the lay of the block, while at the same time aiming at uniformity. The trees should be lined out straight from every angle. The first object is to strike a base line. This line should be parallel with one of the boundary-lines. Next stick a line as nearly as possible at right angles to the base line. Correct this on the 3-4-5 principle: that is, measure 30 ft. along the base line, and 40 ft. along the right-angle line, and, if correct, the distance from point to point will be 50 ft. Correct the right angle until these measurements work out exactly. Once a correct start has been obtained in this way the further pegging-out becomes a very simple matter, checking occasionally as indicated at the outset.

When the positions for the trees are all pegged out, and planting operations commence, avoid planting too deeply. Planting the tree about the same depth as it was in the nursery is a fair guide. This can be ascertained by the mark of the nursery-soil on the bole of the tree.

Trees for planting should either be thrifty one-year-old rods or well-headed trees. Badly headed trees should be avoided. The average nursery, unfortunately, produces a high percentage of such trees, owing to which the popular demand has recently been for well-grown rods.

Pruning the rod is a very simple matter. It consists of selecting suitable buds for forming the head of the tree, and removing the top about 18 in. or 20 in. from the ground. The correctly headed

tree is treated as a two-year-old. Three suitable branches are selected and the remainder removed. Cut back the selected wood to 4 in. or 5 in. from the base, selecting buds suitable for doubling the number of branches. There is, however, no very definite rule to lay down in reference to this work. More or less severe cutting must be adopted, but this must be largely governed by the position and strength of the growths selected. Work always with the idea that one well-placed limb at this stage is very much better than two that are badly placed. In pruning badly headed yearling trees it is invariably more satisfactory to remove the head altogether and make a fresh start, as in the case of the rod.

POULTRY-KEEPING.

F. C. BROWN, Chief Poultry Instructor.

BREEDING.

THE coming month should see all of the breeding-pens mated up. July is thus the most important month of the poultry-keeper's year, for it is only when great care is taken in the matter of selection and mating that an ideal type can be set and the necessary characters intensified with any degree of certainty. Haphazard breeding will sometimes produce good stock, but, generally speaking, it spells a full crop of disappointments. Profitable production means profitable stock, and it is only by paying strict attention to the underlying principles of breeding that the poultry-keeper can hope to build up a high-class laying-flock. The quality of the parents is the first consideration, and too much importance cannot be attached to this. It should be unnecessary to emphasize that if good stock are to be produced generation after generation only purebred parents of fixed types should be bred from. It is certainly true that a first-cross bird may give a prolific egg-yield, but when bred from she seldom transmits her laying-qualities, owing to not possessing the necessary fixity of type. It may also be true that a first cross generally makes a good table carcase, but such birds should not be used for breeding. Here again the base must be purebred stock, as it takes two purebred varieties to produce a first cross. The chief objection to breeding from a crossbred is that it invariably destroys fixity of type, and opens the door to reversion and the appearance of latent undesirable characters.

One of the chief weaknesses in farm poultry-keeping to-day is the belief that all that is required to grade up a mongrel flock is to buy a purebred cock each year. The old notion that such stock are more profitable than purebred laying-strains has long been exploded. It is generally estimated that the average egg-yield per bird on the ordinary farm is about eighty eggs a year, whereas it is not uncommon to see a flock of purebred pullets on a properly conducted plant lay from 180 to 200 eggs each in the same period.

As already stated, first crosses may prove to be phenomenal layers—even win an egg-laying competition. Indeed, the practice of crossing two purebred races as a short-cut to increased egg-production, and in some cases, with a view to taking a "hit or miss" chance of winning an egg-laying test, is becoming far too common. A pen of crossbred birds may do ever so well in a laying-test, but it is questionable if any breeder could repeat the performance with birds bred from them. From a breeding viewpoint the distribution of such stock through the country invariably proves a source of vexation and loss to the breeders into whose hands they fall. Many cases have come under my notice where high figures have been paid for alleged purebred males, but when these were introduced to clean races the results were disastrous—not only from an egg-laying viewpoint, but also from the birds' external characters, which indicated in every way that foreign blood had been introduced. May poultry shows multiply and increase in importance; for these, when the birds are judged on a proper standard under which a serious breed-defect means disqualification, are the one and only means we have of maintaining in a state of purity the many beautiful breeds of poultry at our command. Those who are controlling at least one egg-laying competition in Australia are to be congratulated for refusing to allow to compete in this year's test several pens of birds which were not considered good specimens of the breed they represented.

By keeping purebred birds, however, success in poultry-keeping is not assured. This is only one link in the chain. There are good and bad layers in all breeds, so that it is a matter of strain rather than breed that must at all times be considered. The White Leghorn for heavy egg-production and the White Plymouth Rock or Black Orpington as dual-purpose breeds are the most popular at the present time, while the laying-type of Minorca and also Brown Leghorn are fast coming into favour. Birds from these breeds and settings of eggs from tested strains for breeding purposes are available from the Department's poultry-stations at a moderate price, so that there is no excuse for farmers and others keeping unprofitable stock.

Having purebred stock of a high laying-capacity, the next step of importance is the selection of the most desirable birds for the

breeding-pen. Of course, if there is to be any advancement made in the egg-yielding power of the flock, whether large or small, there must necessarily be a breeding-pen, by means of which only eggs from hens of undoubted laying-capacity and of sound constitution may be used for reproduction purposes. On all plants there is necessarily a variation in egg-yielding power of the different birds as well as in other points, so that if eggs are selected from a general flock the maximum egg-yield will never be maintained. In mating stock the breeder should aim at selecting birds of uniform type. That there is a laying-type has now passed the problematical stage; so that if different types are used as breeders, uniform laying-capacity cannot be expected from the progeny. Not only is desirable type essential, but strong constitutional vigour must go hand-in-hand with it. Constitution is undoubtedly the base of breeding operations. No matter how good a bird may be on breed-type or even on trap-nest performance, it will fail to produce high-grade stock if it is not in a vigorous healthy state at the time of mating.

In the last February *Journal* some advice was given in regard to the most suitable class of hen to breed from, and it was recommended that these should be then selected. In cases where the advice was acted upon, and the birds selected and marked accordingly, the work of mating is now a simple matter. It was clearly pointed out that the proposed breeders for this season should be chosen before the commencement of the moulting process, for it is then and only then that the best breeding-birds can be selected. For a bird to give a heavy egg-yield and be a long-seasoned layer she must necessarily be a late moulter, and it is next to impossible to detect such birds if the work is left until the whole flock has moulted. Of course, where individual records have been kept by means of trap-nests, single pens, &c., the birds can be mated according to their productive capacity, for these are the only means of knowing accurately the laying-power of a bird. This system of selection is chiefly the work of the specialist, and is not usually adopted by the side-line poultry-keeper. Therefore if nothing is known of the laying-power of a bird she must necessarily be selected by her general appearance, and there is no better guide to this than by choosing the late moulter.

This should go hand-in-hand with laying-type and points indicative of a strong constitution. While it is impossible to estimate from the appearance of a bird the exact extent of her laying-capacity, it is easy enough to tell whether she is of a laying-type. The eye for form is certainly a natural gift, but it can to a very large extent be developed by close study and observation. The shape of the bird denotes whether she is an egg-producer or a meat-maker, and a

practical man can as a rule readily distinguish between the two types. The qualifications to be looked for in a good laying-hen are indicated by an oblong body, full at crop, deep and full abdomen of fine texture, the bird thus tapering from thighs to head with a wedge-shape appearance. The legs should be of medium thickness (the shank being short and the bone flat) and set wide apart. The head should be short and broad, eyes bold and bright, face clean and free from wrinkles, the feathers tight, and an active, alert appearance possessed.

In selecting a male to head the breeding-pen it is important that he be the son of a heavy-laying mother. In addition, he should possess a strong constitution. This implies short shanks set well apart, good chest-development, width across the saddle, tight feathering, and generally an alert, bold carriage. While feminine characters should be looked for in the female the male should be practically at the other extreme. The head should be masculine in every respect, but this should not imply coarseness.

FREE RANGE ESSENTIAL.

A good range for breeding-stock is another matter which should not be overlooked if eggs containing strong germs are to be produced. While constitution is of paramount importance it is most of all in the breeding-stock that it must be aimed at, and there is nothing more conducive to promoting this than providing as natural conditions as possible during the whole time the birds are mated. In this connection there is no comparison between the vigour of chickens hatched from birds kept in confinement and those reared under more natural conditions. I have known of many cases of poor hatches and heavy mortality in the brooder stage which could be all traced to the confined conditions under which the parent birds were kept. With the egg-yielding power of fowls being steadily increased, and the heavy tax which is consequently being made on the reproductive organs, it only stands to reason that the demand on the constitutional vigour on one hand, and the risk of the birds being swept off by disease on the other, are also correspondingly increased. Disease among poultry is becoming far too common. This is the one great thing that poultrymen have to fear, and the only sound means of dealing with it is to prevent it, the first essential of which is to breed stock with that vigour which implies power of resistance. There is no hard-and-fast rule as to the number of hens to mate with a male. This largely depends on local conditions, and also the vigour of the male. Where a free range is available a strong male will serve from twenty to even thirty hens, whereas under confined conditions half the number would be too many.

THE APIARY.

E. A. EARP, Apiary Instructor.

MOVING OF BEES.

AT this season of the year bees may be moved with perfect safety to a new location. If the work is left until spring, when the activities of the hive commence, the resultant loss of field-bees will be enormous. More especially should advantage be taken of the bees' dormant condition if the hives are to be moved short distances only. The colonies are numerically weaker, and there is usually little brood to become injured in transport. When hives are located for any length of time in one position the flying bees take full observation of every landmark, but as in the winter there are shorter periods of sunshine the flight of the bees is necessarily curtailed, and they usually return at a much shorter distance from the hive. In addition, there are often periods of several days together during which they take no flight at all, and in consequence they must renew their acquaintance with their surroundings when an opportunity for flight occurs. Therefore if the hives are moved during a spell of bad weather the bees will take more readily to their new location when a fine day comes. Any bee-shifting operations should be completed before the end of July.

To secure bees for transit over a short distance sufficient ventilation can be provided by tacking a piece of wire gauze over the hive-entrance. It is then only necessary to secure the bottom and roof, and after making sure that there are no holes through which the bees can escape the hive may be carried with perfect safety.

The successful moving of bees over long distances calls for considerable preparation. All heavy combs should be secured, and only sufficient honey left in the hives to prevent the bees from starving during their journey. The most important factor is ventilation, and it is the neglect of this matter which leads, as a rule, to heavy losses when bees are being moved. The constant vibration of any vehicle tends to disturb the cluster, and the excitement caused thereby is sufficient to raise the temperature of the hive considerably, so that the bees are in danger of being suffocated and the brood scalded. These troubles can be avoided by the employment of wire screens. First see that the frames are made as secure as possible by inserting two wedges between the side of the hive and the top of the end frames. This prevents the frames from rocking during transit. The bottom-board should then be secured to the hive-body by means of crate-staples, driving one end of the staple into the hive-body and

the other into the bottom-board. Usually six staples are sufficient. The screens can be made by using narrow laths nailed together to form a frame of the same dimensions as the hive-body, and covering this with wire cloth, such as is used for making queen-cages. The screens must be securely fastened to the top of the hive and the entrance covered with wire cloth. By this means ample ventilation is provided to ensure the safe carriage of the bees during the winter months.

In these days of motor transport the work of moving bees over long distances is greatly minimized, and the beekeeper will be well advised to adopt this method if it can be obtained. In any case the beekeeper who has occasion to move bees should not relax any effort to make the hives secure when moving to a new location.

DRY MATS.

At intervals during the winter months the mats should be examined to note their condition. After heavy rain the mats are liable to become damp. These should be removed and dry ones substituted. To save delay a supply of dry mats should always be kept on hand. As far as possible, do not disturb the colonies when making an examination, and especially avoid jarring the hives. The roof can be carefully lifted and the mat examined. If the latter has to be removed see that the smoker is handy in case the bees are troublesome, but do not use smoke unless the bees have to be driven down. Remove the wet mat as speedily as possible, replace it with a dry one, and cover the hive.

LEAKY COVERS.

In cases where damp mats are found they usually point to defects in the covers, and it should be worth the beekeeper's while to remove these also. At all seasons the comfort of the bees should be one of the main considerations, and this factor cannot be ignored if successful wintering is to be expected. The labour involved in keeping the hives watertight will repay their owner many times over, and prevent to a large extent the loss of heat generated by the bees. The beekeeper should aim at reducing the waste of energy of the bees by maintaining the heat of the cluster at an even temperature during the unproductive season, and this will be impossible where leaky roofs are tolerated. Successful wintering is a high test of the beekeeper's capabilities.

PERMANENT SHELTER.

Now that the actual work of the apiary is off the beekeeper's hands for a while he may devote his attention to the matter of pro-

viding permanent shelter for the hives. If he has definitely decided on a permanent location for the apiary he should now set about the cultivation of a quick-growing hedge. This matter is a most important one, and ranks next to that of locality. It is noticeable in sheltered situations that the bees are able to take cleansing flights during the mild days of winter, whereas bees in unsheltered positions are often confined to their hives even on sunny days. An occasional flight in the winter is as necessary for the welfare of the bees as any provision the beekeeper can make for their comfort. In addition to protecting the bees during the winter months from stormy winds, it is an incentive to increased brood-rearing in the spring and early summer.

Whatever shrubs or trees are provided for the purpose of producing a permanent hedge, they should be planted thickly and trimmed to produce abundant foliage, especially at the base. It is highly important that the plants shall stand cutting back, so that the hedge can be kept at a reasonable height. Hedges grown to a height of 8 ft. to 10 ft., and no higher, will provide ample shelter for a large apiary, and there will be less trouble in taking swarms if the trees are kept to the height indicated. Locality and situation must to a large extent influence the beekeeper in choosing the most suitable plants, but, whatever the hedge, the idea should be to form thick shelter and not set out to form a plantation.

WAX FOR FOUNDATION-MAKING.

It is alleged that there is a shortage of beeswax in the Dominion, and as there is an indication that supplies are not sufficient to meet local demands it behoves producers of wax to save every ounce, so that they may assist in making up foundation for the coming season. Last season many districts were hard pressed for supplies to carry on, and foundation rose to 4s. per pound, notwithstanding that in quite a number of districts it was being manufactured as fast as supplies of wax could be secured. The apparent shortage is not due to decreased production, but mainly to the large quantities that are absorbed in making up proprietary articles. The beekeeper is often influenced by the ruling rates offering, and is content to part with his wax at the close of the season rather than wait to have it converted into foundation at the minimum cost of 8d. per pound, this being the general rate of manufacture in the Dominion. Taking the selling-value of wax at approximately 1s. 4d. per pound and adding the cost of conversion into foundation, it is quite evident that to hold the wax for manufacture is a paying proposition for the beekeeper, more especially as the ruling rate to-day of medium brood-foundation is 3s. per pound.

It has been asserted that there is a danger of introducing disease by using comb-foundation made up from local wax. This is contrary to fact, and it would be an easy matter to quote instances of foul-brood being eradicated from large apiaries where only locally made foundation had been used. The heat that the wax is subjected to prior to its being converted into foundation is in itself sufficient to destroy the destructive germs of foul-brood, and the beekeeper need have no fear of introducing disease by using the locally made article, even though the wax has been won from bees that have died from the disease. So satisfied was one of our large beekeepers that the destructive bacteria of foul-brood are killed when preparing the wax that, although for several years he has not had the slightest trace of the disease, he readily consented to allow his apiary to be used for the purpose of carrying out a series of exhaustive experiments to determine that it is quite safe to use foundation made in the Dominion. The claim that the locally manufactured article is free from bee-diseases is quite justified; moreover, the experiments which have been carried out are sufficient to put the mind of the users at rest. Therefore before next season arrives the beekeeper who is studying his own interests will have made arrangements to place his wax in the hands of the local maker. In doing this he will be materially assisting the industry besides directly benefiting his own pocket.

THE GARDEN.

W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

In relation to gardening July is treated as the first month of spring. The first sowing of peas, as part of the routine for the season, should be made early in the month, and be followed by other sowings at intervals of a fortnight until January. Sow now both a dwarf and a taller variety; the latter will be in use before the dwarf is past. Dwarfs should not be sown after the first sowing, which may be somewhat later in some places. It is a good plan to strew a little soot over the peas before covering them. Soot is a valuable fertilizer for peas, and prevents injury by wireworms and slugs.

Broad beans should be sown, unless they were put in during June. All the carrots at present in the ground will run to seed in the course of a month or two, therefore a small sowing of an early horn variety should be made as soon as possible. Other seeds to

sow may include turnip-rooted beet, cabbage, cauliflower, lettuce, red cabbage, turnip-rooted parsnip, celery, onions, parsley, and other herbs. Celery must be sown in boxes under glass.

Useful herbs that can be got from seed are thyme, sage, and marjoram. The sweet or knotted marjoram is best, though not so commonly grown as pot marjoram, which is a quite different plant —winter savory. The latter is a perennial evergreen plant; it is termed winter savory in contradistinction to summer savory, which is an annual, and not so useful a plant. Lemon-thyme (not the variegated variety) is a better plant than common thyme, being more leafy, standing drought better, and having a more piquant flavour. It seldom seeds, however, and plants only can be obtained. Seedless sage is a more leafy and succulent species than common sage, and is also obtainable from plants only.

Onions should be sown as early as the condition of the soil will permit. The earlier they are sown the better the prospect of success, always provided the soil is well drained, so that it will remain warm enough to ensure continuous growth. Early-sown crops should mature early and have made their growth before the appearance of mildew. The soil for onions should be of a non-binding character; if it sets after rain a lot of labour is caused or inferior crops result. The soil should be turned over several weeks before sowing if possible, and at the same time a liberal quantity of stable or stockyard manure worked in if it is available. If not, give 2 oz. per square yard of superphosphate and 1 oz. of sulphate of potash. Wood-ashes and soot are both valuable for onions. Nitrate of soda will be valuable later on, but should not be given till the plants are in growth. Drills should be made as shallow as is possible, the seeds to be just covered, no more. In large breadths the drills should be 15 in. apart to allow for machine cultivation, but 12 in. apart is sufficient for gardens. Three pounds of seed will sow an acre.

Planting operations will include setting out cabbages, cauliflowers, lettuces, autumn-sown onions, rhubarb, potato-onions, garlic, shallots, and the division and replanting of herbs. Clumps of thyme can be pulled into as many pieces as they will make; each division will quickly make a good clump. Marjoram and savory are amenable to the same treatment. Mint does best in a rather damp place, but will do in any fairly good soil; the roots must not be covered too deeply. Sometimes nothing but a mat of roots can be got. In such cases, lay the clump on the surface, pat it down with the back of the spade, and throw a little soil over it.

Potato-growing under garden conditions is dealt with elsewhere in this issue of the *Journal*.

ANSWERS TO CORRESPONDENTS.

IN every instance a question to which an answer is desired in the *Journal* must be accompanied by the full name and the postal address of the inquirer, not necessarily for publication, but as a guarantee of good faith. The question should be written on one side of the paper only.

OLIVES IN NEW ZEALAND.

N. E. B., Hokianga :—

Will you please tell me what varieties of olive-trees are the best to plant for the production of oil? Where can olive-trees be obtained, as the nurserymen do not stock them? Do the Department's horticultural stations supply them? At what age do olives commence bearing? What number of trees should be planted to make it worth while to install a crushing plant?

The Horticulture Division :—

Olives have been tried a number of times in New Zealand, and considerable olive-groves were planted by the late Sir J. Logan Campbell many years ago. Some of them, though neglected, still exist near Auckland. Oil of quite good quality was expressed, but it has been found that the good qualities of oil could be imported more cheaply than they could be produced here. The importations come from South Australia, America, and southern Europe. The feasibility of pickling olives has previously been discussed, but the consumption of pickled olives in New Zealand is so infinitesimal that it is not worth thinking about, while it would be quite impossible for us to export in competition with the exporting countries mentioned. Olive-trees are not raised at the horticultural stations. The trees would not be very productive until ten or twelve years from planting.

TIME FOR DEHORNING COWS.

"INQUIRER," Totara Flat :—

Kindly advise which is the best time to dehorn milking-cows. Is there any harm in performing the operation now—within three or four months of calving?

The Live-stock Division :—

The best time to dehorn cows is when they are empty—say, a month after calving. The operation at this time will affect the quantity of milk for about two days, but this is preferable to dehorning when the animals are in calf, as there is then always a risk of some of them slipping their calves. Timid cows should not be dehorned.

LIME-SULPHUR SPRAY FOR POTATOES, ETC.

E. B., New Plymouth :—

Could you tell me if lime-sulphur spray is suitable for spraying potatoes? Is it as good as Bordeaux mixture, as bluestone is very dear and hard to get now? If so, what strength would you advise it being used at on potatoes and tomatoes?

The Horticulture Division :—

For spraying potatoes and tomatoes lime-sulphur is not recommended, as it is not considered to be as good as Bordeaux mixture, or copper sulphate in some form, such as Lawes Anti-blight and Cooper's Bordeaux. When, however, there is difficulty in obtaining copper-sulphate mixtures lime-sulphur may be used at from 1 in 100 to 1 in 125 strength.

KEEPING ARTICHOKES.

"SUBSCRIBER," Fortrose :—

What is the best way to store artichokes for seed from one year to another? Last year I stored some in the open, but they became so dried up that this season I have pitted them in dry earth.

The Horticulture Division :—

Artichokes should be left in the ground through winter. They begin to grow again about August. About that time lift all that are left in the ground; select medium-sized tubers, and plant them at once. Artichokes do not store well in any way except in cold countries, where they are stored in cellars, the tubers being covered with sand.

NUT-GROWING.

"FILBERT," Oamaru :—

Kindly state if there is anything to be made out of growing nuts, particularly filberts, in the South Island; if so, give particulars as to number of trees to the acre, the time taken in coming to maturity, the probable weight from each tree, &c. Would a southerly or south-westerly slope exposed to cold south-westers be unsuitable?

The Horticulture Division :—

So far filbert-growing has not been undertaken on a large scale in New Zealand. It is a paying industry in England. It should, however, be understood that the trees are not profitable if allowed to grow in their own way; they must be scientifically trained and pruned. In England, nuts do better on slopes than on flat land, because less liable to frost injury. Soil that is not too rich is best, but the subsoil must be loose. Some shelter would be necessary in a position exposed to violent winds in spring, or the pollen-bearing catkins would largely be lost before fertilization was effected. In England the nut-orchards are hand-dug, and the trees are planted from 10 ft. to 12 ft. apart. In this country horse-labour has to be employed, and the trees must be at a greater distance to allow of that. Planting 17 ft. apart would require 150 trees per acre, or 16 ft. apart 169 per acre. The trees would be from eight to ten years reaching a size that would produce a full crop, which is about half a bushel per tree.

AGE OF MATURITY IN COWS.

"LEARNER," New Lynn :—

At what age does a dairy cow stop growing, and when does she start to decline?

The Live-stock Division :—

A cow has finished teething at about three years and four months, and these are in full wear at four years old, when the animal can be looked upon as fully matured. She should be at her best for the next five years, but after ten years old must be looked upon as liable to begin to go off. There are, of course, many exceptions, but this may be taken as a general rule.

PROPAGATING CHERRY-PLUMS

F. W. L., Waihi :—

Kindly say whether cherry-plums can be grown from cuttings, or if it is necessary to plant stones.

The Horticulture Division :—

Cherry-plum trees can be grown from cuttings. Wood of the past season's growth should be used, the cuttings to be from 12 in. to 15 in. long, and half buried in the soil. They should be put in at once, as the season is getting rather late for that purpose.

TREATMENT FOR TUTU POISONING.

F. C., Apiti :—

Could you advise me of any treatment for cows (or even dry cattle) which have been eating tutu? I had two of my best milking-cows that way within the last month, and have lost both of them.

The Live-stock Division :—

It is often a very difficult matter to apply medicinal treatment to animals suffering from tutu poisoning, seeing that the trouble causes more or less severe brain symptoms, which render the animal intractable and difficult to handle. Very useful treatment for this trouble, when it can be applied, is the internal administration of liquid ammonia, or carbonate of ammonia mixed with milk or thin gruel, if possible; in addition a large dose of linseed-oil—not less than 2 pints—should be given. The dose of liquid ammonia in cases such as this should be 1 oz. in a quart of milk or thin gruel. If neither of these be available, the ammonia should be mixed with the 2 pints of linseed-oil recommended above. Liquid ammonia is irritating to the membrane of the mouth and throat, hence the necessity for diluting it with a quantity of some demulcent fluid. It should be borne in mind that there are two liquid preparations of ammonia—one a very strong preparation known as "liquor ammonia fort," the other the ordinary liquid ammonia, which is here recommended. If carbonate of ammonia is used in cases of tutu poisoning the dose is 1½ oz.

If the rumen (first stomach) is greatly distended with gas, relief can be afforded by puncturing it at a spot between the haunch-bone and the last rib. This should be done on the left side of the animal. The best instrument for such puncturing is that known as a trocar, fitted with a canula. The trocar is a round, sharp-pointed instrument with a metal tube (the canula) fitting tightly over it. After making the puncture the instrument is withdrawn and the tube left in, allowing the continued escape of gas. It is unlikely, however, that the farmer will have this instrument at hand, and in an emergency a sharp-pointed knife with a long but thin blade can be used. In this case the knife must not be simply plunged in and withdrawn, but must be held in position after making the puncture, the blade being twisted slightly sideways, thus maintaining an opening through which the gas can escape from the rumen. Owing to the usually excited condition of affected animals, however, it is often very difficult to carry out this operation. It is usually travelling stock which become the victims of tutu poisoning; and feeding on the plant undoubtedly causes much more trouble when taken on a more or less empty stomach.

SOWING GRASS-SEEDS WITH FERTILIZERS.

P. ALLSOP, Whangamata :—

Can I mix grass and clover seeds with manure in a top-dressing for sowing on rough ground?

The Fields Division :—

Phosphatic manures, which are the only ones that you are likely to use in the laying-down of grass mixtures, can be mixed with the seed; and certainly on rough ground this is the best method to adopt.

CUPRESSUS LAWSONIANA FOR WAITEMATA LANDS.

"WAITEMATA," Silverdale :—

Is *Cupressus Lawsoniana* a suitable shelter-tree for Waitemata lands in respect of speed of growth, safety to live-stock, &c.?

The Horticulture Division :—

Cupressus Lawsoniana would doubtless succeed on the Waitemata lands. You probably are aware that the *Lawsoniana* is slow in growth for the first few years.

MANURES FOR SANDY GARDEN.

T. C., Paekakariki :—

I wish to make a vegetable-garden on the sand-dunes within about 200 yards of the sea-beach. What manures would you recommend? The spot is fairly well sheltered from the winds.

The Horticulture Division :—

Sandy soil is most benefited by liberal addition of strong animal manure—from cow-byres, piggeries, and stables. Stable manure should be decayed to the condition known as "fat." Green-manuring would add humus; white mustard and white lupins are suitable for the purpose. Suitable artificial fertilizers would be superphosphate, blood and bone, and nitrate of soda.

HORSE WITH "GREASE."

D. T., Temuka :—

I have got a mare whose legs are itchy, and have got a dry scab on them not unlike "grease." It is up as far as the hock. One leg is swollen. Could you tell me if there is any cure for the trouble?

The Live-stock Division :—

In all probability the mare is suffering from a form of "grease," which in most instances is confined to draught or heavy horses, and it is presumed this mare is of that stamp. The complaint is more often of a constitutional nature. Such being the case, permanent cure in all cases cannot be looked for, and to relieve and check the disease requires constant attention. Treatment consists of a mild dose of physic, especially if the legs are swollen. The feed should be good, but not too heating, with plenty of green fodder when procurable. The irritation of the legs, and stamping, can be checked by applying Jeyes fluid, 1 in 40, or lysol, 1 in 60; but good results are obtained by the application of zinc ointment, 1 in 8. The surfaces can be cleansed occasionally with tepid or cold water and hard soap. Warm water and soft soap must not be used. Regular and constant work is always beneficial in these cases.

ERADICATING SMALL PATCH OF CALIFORNIAN THISTLE.

"SUBSCRIBER," Eltham :—

Kindly let me know the most efficient means to eradicate a patch of Californian thistle covering about 4 yards square.

The Fields Division :—

Being a small patch, it could be carefully cut down just below the surface of the ground whenever any sign of growth appears. This is the American plan, and is generally successful. A heavy salting with agricultural salt at the rate of 3 tons per acre should also be effective. This of itself would probably destroy the plant, and as stock are fond of salt they would probably tramp the plant out if allowed access to the patch.

NOTE.—If "A Cocky" will forward his name and address to the Editor, information on the lines required will be supplied direct.

Wheat and Oats Threshings.—Returns of actual threshings received by the Government Statistician, to 19th May, from threshing-mill owners showed that 4,484,727 bushels of wheat and 4,793,217 bushels of oats had so far been threshed out this season. The Dominion average yields per acre in cases where particulars of areas were furnished worked out at 23·28 bushels for wheat and 32·09 bushels for oats.

BOARD OF AGRICULTURE.

THE new Board of Agriculture held its first meeting on 29th May, 1917, Sir James Wilson, President of the Board, in the chair. The following is a summary of the proceedings :—

Wheat prices.—It was decided to again write to the Minister of Agriculture on the subject of the price offered by the Government for next season's wheat, and to inform the Minister the Board hoped that, after his experience of what it would cost to bring wheat from Australia, he could now see his way to make the price for next season's crop 5s. 10d. per bushel o.t. (on trucks) instead of f.o.b. This would encourage the growth of a wider area of wheat, and be much more equitable to those wheat-growers a long distance from port selling for local use, seeing that under f.o.b. terms the miller would be entitled to deduct from the 5s. 10d. the freight charges to the port, even though there was no intention of exporting the wheat. Under these conditions a farmer one hundred miles from port would probably only receive 5s. 6d., whereas one who could deliver the wheat himself at the port would receive 4d. per bushel more.

Shipping, Storage, and Production.—The question of the amount of refrigerated space for the storage of the meat, cheese, and butter in the Dominion, and the probable number of steamers available for the export of our produce, was fully gone into by the Board, and all the statistics which had been obtained in connection with the matter were carefully considered. After a lengthy discussion of the position the Board was of opinion that it should be represented at the conference which has been called to investigate the question of shipping-space, if at that conference it is found necessary to go further in the matter and consider how production and stock should be dealt with. The President was empowered to make representations to the Acting Prime Minister to this effect.

Noxious Weeds.—The Board had a conference with Mr. Pope, Secretary, and Mr. Cockayne, Biologist, of the Department of Agriculture, on the question of noxious weeds. It was decided that steps be undertaken by the Department to have a weed-survey commenced, and that a series of experiments be also started to determine the best means of controlling some of our most dangerous weeds.

Potash-supplies.—Mr. Aston, Chemist to the Department of Agriculture, supplied the Board with certain particulars regarding the amount of potash contained in bracken-fern and in the sawmill ashes which are now being wasted. He informed the Board that he was continuing these investigations, and hoped that methods would be devised to profitably utilize for manurial purposes the potash that might be obtained from these and other sources in the Dominion.

Importation of Phosphates.—Attention was called to the fact that some difficulty had arisen with regard to obtaining necessary shipments of phosphates from Makatea Island, owing to the scarcity of tonnage and high freight-rates since the war commenced. It was decided to communicate with the Minister, urging that in order to obviate a serious shortage of fertilizer every facility be given to enable the ship now under charter between New Zealand and Makatea to complete the number of trips that have been arranged for.

Uniformity of Flock and Stud Books.—A letter was received by the Board pointing out the importance of bringing about uniformity in the flock-books in New Zealand, and requesting the Board to endeavour to arrange for a conference of the representatives of the various breed societies throughout the Dominion during the forthcoming meeting of the Council of Agriculture, to be held in Wellington at the beginning of July next. After discussion it was decided to adopt the suggestion contained in the letter, and to communicate with the stud-book authorities as well as the various bodies interested in the matter.

Diseases in Turnip Crops.—A long discussion was held with Mr. Cockayne, Biologist of the Department of Agriculture, on the very serious spread of club-root and other diseases in the turnip crops throughout the Dominion, and it was decided to request that the officers of the Department should bring this matter up for discussion at the forthcoming meeting of the Council of Agriculture.

Report for Council of Agriculture of Work of Board of Agriculture.—A report that had been prepared for submission to the Council of Agriculture on the work

of the Board during the past year was brought before the meeting by the President. After the report had been considered it was adopted, and it was decided to send it on to the Council accordingly.

Proposed Agricultural Legislation.—The Board had a discussion with Mr. Pope, Secretary of the Department of Agriculture, in reference to the encouragement of the breeding of horses for military purposes; a Seeds Bill; and an amendment of the Fertilizers Act, 1908. It was pointed out that some of the Bills that had been asked for by the Council of Agriculture, the New Zealand Farmers' Union, and other agricultural bodies were of a non-contentious nature, and that it might be possible to get something done on the lines suggested even during the war, as it was of the utmost importance to do everything that was practicable to stimulate the fullest development of the natural resources of the Dominion, which play an important part in keeping the war going, and to which we must look for meeting our obligations after the war.

Improvement in Dairying and Management of Dairy Herds.—The question of improvement in dairying generally and in the better management of dairy herds was considered, as was also the importance of educating the young people on the farms in these matters. Mr. O. J. Hawken, the representative on the Board for the Taranaki District, gave some interesting details with regard to the movement in that province to establish a model dairy farm under the management of the farmers themselves assisted by a Government subsidy. The opinion was expressed that such a farm would be of considerable service to settlers in that centre, and the Board discussed with Mr. Pope the practicability of initiating a series of short courses and lectures on dairying matters during the winter months, to be given by officers of the Department. Mr. Pope thought that arrangements could be made to give effect to the wishes of the Board in this direction.

POTATO-SCAB.

THE following information regarding potato-scab was furnished by the Horticulture Division to a correspondent (a garden-cultivator) who had forwarded an affected tuber:—

What is commonly known as potato-scab is now one of the most widely distributed fungoid diseases attacking the potato-tuber, being found in all parts of the Dominion. Its attack usually commences when the tubers are quite young and the skin soft. Rounded scattered rough patches are formed on the surface, and these often increase to such an extent that the whole tuber may become covered; in bad cases the potatoes often become cracked, and their market value greatly depreciated. The quality of the "scabbed" potatoes is not much impaired, and they are quite fit for all culinary purposes. The cause of the disease is a fungus only known in the conidial form, and called *Oospora scabies*. The hyphæ of this fungus are very small and delicate, giving rise to numerous small ovoid spores.

If "scabby" potatoes are used for seed without being properly treated the resulting crop is certain to be diseased. The fungus can also live for several years in the soil without the intervention of a potato crop. Scabby potatoes can, however, be used for seed with perfect safety if they are immersed for two hours in a solution consisting of 1 pint of commercial formalin (= 40 per cent. formaldehyde) mixed with 40 gallons of water. The potatoes are then spread out to dry, and when dry are ready for planting. Great care must be taken not to place any of the treated seed in bags which have previously contained scabby sets. The use of formalin is much to be preferred to corrosive sublimate, which used to be looked upon as the standard remedy. Even so, it is not advisable to use scabby potatoes for seed; tubers so affected are best discarded altogether for this purpose.

Land in which scab is prevalent should not, unless necessary, be planted with potatoes for several seasons. Beets and carrots are also said to be liable to this disease, but up to the present we have not seen it in carrots in New Zealand, though several cases of beets so attacked have been examined. Cereals may be sown on infected land. In gardens, &c., where potatoes are grown annually the ground should be sprinkled with sulphur. Lime increases the disease; acid manures act as retarders.

THE EMPIRE'S WOOL.

PROPOSALS FOR FUTURE CONTROL.

THE Department has received a copy of an Interim Report on Wool, presented recently by the Textiles Committee of the British Board of Trade, dealing especially with the international-economic aspect of the subject. The Committee summarizes its conclusions as follows:—

Of the world's total production of clothing-wools in 1915 the British Empire produced more than 50 per cent. Of merino or fine wools the Empire contributed 63 per cent., and of crossbred wools 40 per cent.

Inasmuch as the domestic clips of the United States and most European countries are consumed in the Home market, and are far from sufficient to meet the requirements of their woollen industries, they are dependent for their additional supplies on the wool-exporting countries of the world, which may be divided into two groups—the British Empire and South America.

Of the world's production for export, the British Empire contributed 68 per cent. and South America 32 per cent. Taking the two types of wool, we find the exportable production as follows:—Merino: British Empire, 85 per cent.; South America, 15 per cent. Crossbred: British Empire, 46 per cent.; South America, 54 per cent.

The finer merino wools are virtually a monopoly of the British Empire, and before the war enemy countries consumed about 30 per cent. of the British supplies. These wools are a vital necessity for the production of the finer German and Austrian textiles, in which Germany and Austria excel. It would not be practicable to substitute South American merino wools for them, as they produce fabrics which are much rougher to handle. The British Empire, therefore, is in a position to completely control the supplies of raw material for the German fine-wool dress-goods trade.

There has been of late years a serious decline in the production of merino wools, owing to (*a*) serious droughts in Australia and a consequent reduction in the number of sheep; (*b*) the fact that crossbred sheep are gradually supplanting merinos, owing to the requirements of the frozen-meat trade; (*c*) the gradual encroachment of arable upon pastoral land in South America.

This shortage has been intensified by the enormous increase in the American consumption of merino wool, due to (*a*) the placing of wool on the free list of imports into the United States of America by the Tariff Act of 1913; and (*b*) the enhanced purchasing-power of the United States resulting from the war.

The decrease in Continental consumption during the war has been offset by the increase in the military demand for wool.

The result of these factors is a world-wide depletion of wool-stocks, and a current level of prices fully 75 per cent. above pre-war averages.

After the war there is likely to be an increased demand, due to (*a*) the demand for civilian clothes by the troops as they are disbanded; (*b*) the enormous demand for civilian requirements, which has been postponed during the war; (*c*) the requirements of the Allies to restock the devastated districts, and to extend their manufacturing industries; (*d*) the probable continuation of the United States demand, due to the great prosperity of that country; (*e*) the urgent needs of Germany and Austria, which countries, it may be assumed, are almost entirely depleted of raw wool.

In view of the future shortage of wool, particularly merino, and in order (*a*) to fulfil our obligation to our Allies, to which we are pledged by the Paris Conference; (*b*) to safeguard our own industrial requirements; (*c*) to prevent the export of wool to present enemy countries, there appears to be urgent need for efficient control of the Imperial wool-supplies after the war.

Such control can only be exercised by H.M. Government with the consent and co-operation of the wool-growing Dominions, and any scheme should be formulated in close consultation with the Dominions' Governments.

Control might be exercised, with or without an export duty, in two ways: (*a*) By a system of controlling exports by license, or (*b*) by State purchase.

RECOMMENDATION.

The Committee recommends that, in view of the serious shortage of wools for clothing purposes, particularly of merinos, and in view of the predominant position of the British Empire in the production of these wools, H.M. Government should be urged to convene, at an early date, a conference of the representatives of the Governments of Australia, New Zealand, and South Africa, in order to formulate a workable scheme for the effective control of the distribution of all wool grown within their territories, with a view to (*a*) the fulfilment of the pledges to the Allies, as laid down in the Paris Resolutions; (*b*) the complete safeguarding of British industrial requirements; and (*c*) the utilization of the wool resources of the Empire to their fullest capacity as a means for bargaining or otherwise.

The Committee suggests that a co-ordinated policy of shipment under license during the period of reconstruction offers the least difficulties. Under such a scheme, exports to enemy countries would be prohibited for a period of at least one year after the conclusion of peace, and for such further period as might be found desirable, and exports to neutral countries would be restricted to the quantity of wool available after satisfying the requirements of the British Empire and its Allies.

CROWN LANDS.

AREAS FOR SELECTION BY DISCHARGED SOLDIERS.

THE Department of Lands and Survey is now announcing a number of good properties for selection by discharged soldiers, among which the following may be noted:—

AUCKLAND LAND DISTRICT.

Streamlands Settlement.—Area 1,469 acres, divided into twelve holdings; situated about four miles from Kaipara Flats Railway-station. It comprises first-class land suited for dairying and mixed farming. Date of opening is 25th June; sale poster 1319.

Tapapa Settlement.—Area 1,145 acres, divided into ten holdings. This property is situated about two miles and a half from Hinuera Railway-station, and consists of flat to undulating first-class land, with soil generally of a dark loamy nature, adapted for dairying and general farming. Date of opening, 25th June; sale poster 1320.

Other Holdings.—About eighteen other holdings in various parts of the district will be opened on the same date, including a block of nine holdings in Pirongia Survey District, three miles from Te Rauamoa Post-office and fourteen miles and a half from Otorohanga. The sections in Pirongia Survey District range in area from 331 to 622 acres, and consist mostly of fairly broken bush-clad country. These lands are advertised on sale posters 1321 and 1322.

WELLINGTON LAND DISTRICT.

Putorino Settlement.—Area 1,049 acres, divided into fifteen holdings, ranging in area from 49 to 82 acres. Consists of rural alluvial flats rising in a series of terraces from the Rangitikei River. Situated about four miles from Rata Railway-station, on the Main Trunk line, and is now in splendid grass. It is proposed to supply every section in this settlement with a high-pressure water-service from a dam about a mile away. Date of opening, 28th June; sale poster 736.

ORGANIZATION OF AGRICULTURAL LABOUR, ETC.

THE following memorandum has been issued to Trustee Boards by the Wellington Commissioner of the National Efficiency Board, Mr. T. Moss, under date 2nd June 1917:—

It is desirable that no time should be lost in ascertaining what labour will be required in your district in connection with the conduct of agricultural and pastoral work during the ensuing twelve months, more especially shearing, ploughing, and harvesting. It is therefore requested that you will hold a meeting of your Board of Trustees, and make full inquiries throughout your district with a view to ascertaining what labour is now available in the various branches, what reduction of labour is likely to take place by the operation of the Military Service Act, and as to how far by co-operation or other means the labour can be organized and the requirements met.

A circular letter was sent out by this Board to all the secondary schools in the Dominion, and a very large proportion of the Boards of Governors have consented to decrease the duration of the spring holidays, and to correspondingly increase the length of the summer holidays, so that there will be a certain amount of boy-labour available for assistance in the shearing-sheds and other operations during the summer holidays. It will be necessary for this labour to be organized in each district to the extent that the farmers and station-holders who desire such assistance will have to make clear what accommodation they are prepared to provide and what number of boys they desire. It is probable that in many cases the town boys will prefer to go to their country friends, and the country boys will naturally be at their homes. All this information requires to be worked up in anticipation. In those cases where people are prepared to take in strangers it will be necessary to satisfy the schoolmasters and the parents of the boys that they will be properly looked after. The rates of wages will presumably be those usually paid in the district.

The suggestion is therefore made that not only should you get the information for your own district, but that you should get into touch with the Trustee Boards in adjacent districts, so that the whole country may be organized on a uniform scheme and systematic plan. It probably may be found to be desirable, when the information is obtained—say, in about a month's time—that the Commissioner should arrange for delegates from the various Trustee Boards to meet together at some central point or points to exchange ideas and to arrange for organization on similar lines throughout the districts.

A further matter for your consideration is to ascertain as to how far an increase of stock may be carried in certain portions of the district, and how far there is a probability of other portions being overstocked. Also, it is desirable that inquiries should be made—so that some conclusion can be arrived at—as to what feed is available for carrying the stock through the winter, so that in case there should be a shortage in any place some co-operative and systematic arrangement could be made by which stock from certain districts could be depastured in other districts where an excess of feed exists.

EXPORTATION OF CHEESE.

IT is notified by the Comptroller of Customs, under date 12th June, 1917, for general information, that the following classes of cheese may be exported to consignees, other than the British Government, in the United Kingdom and British possessions and protectorates:—

Stilton cheese.
Cheddar cheese (3rd grade).
Cheddar cheese (1st or 2nd grade) of less size than that known as "Export size."
Dairy cheese.

Applications must be made to the local Collector of Customs, specifying the marks and numbers, number of packages, names of shippers and consignees, names of exporting vessels, and ports of final departure from New Zealand.

This notification extends and supersedes notice dated 7th February, 1917.

HIGH COMMISSIONER'S CABLED MARKET REPORTS.

London, 19th May, 1917.

Meat.—Owing to small supplies of all descriptions of meat prices are higher for Home-killed mutton and beef. New Zealand mutton, per lb., 8¾d.; ewes, 8½d. New Zealand lamb, 10d. Argentine mutton, 10d. Argentine lamb, 11d. Quotations are nominal. Conditions of sale are same as during last week. Argentine chilled beef, hinds 13¼d., fores 11¾d.

Butter.—Market is quiet but steady. Prices are easier. Danish, salted, per cwt., 204s. to 208s.; New Zealand, salted 202s. to 206s., unsalted 204s. to 208s.; Australian, salted 190s. to 194s., unsalted 192s. to 196s.; Irish, salted 194s. to 198s., unsalted 198s. to 200s.; Argentine, salted 186s. to 190s., unsalted 190s. to 192s.

Cheese.—Market continues firm. Canadian, white and coloured, per cwt., 162s.; States flats, 160s.

Hemp.—Market remains firm. There is a general and active demand, but little offered from New Zealand. It is reported that 70,000 bales are afloat from Manila under Government control. New Zealand fair, May to June, selling at £83 per ton; good-fair, on spot, nominally £84 10s.; fair £83 10s.

Wheat—Market quiet but firm. Canadian, per quarter, 81s.

Oats.—Firm market; but, as Government has entire control, market steady and likely to remain so. New Zealand, per quarter, 56s.

26th May, 1917.

Meat.—Home-killed mutton and beef are in fair supply, and as high as 19½d. and 14½d. per lb. All descriptions of frozen meat are very scarce, and demand is very active. More Argentine mutton and lamb is now selling at official quotations. Government is releasing large quantities of controlled meat in order to steady the market. New Zealand mutton 8¾d., ewes 8½d. New Zealand lamb 10d. Argentine mutton 10d. Argentine lamb 11d. Argentine chilled beef (small supplies), hinds 13½d., fores 10¾d. Buyers for low grade on account of the weather.

Butter.—The following maximum prices have been fixed for the next two weeks: New Zealand, 208s.; Australian, salted 202s.; Irish, salted 204s.; Argentine, salted 198s.; Danish, 218s. Market has a downward tendency. Danish butter, 202s. to 204s., salted; New Zealand, salted 194s. to 196s., unsalted 194s. to 198s.; Australian, salted 188s. to 192s., unsalted 190s. to 194s.; Irish creamery, salted 192s. to 196s., unsalted 194s. to 200s.; Argentine, no official quotations, no arrivals.

Cheese.—Maximum cheese-prices remain unchanged. Market is easier; buying is confined to immediate requirements. Canadian, white and coloured, 162s.; States flats 158s. to 160s. Quotations for States flats are nominal; imports are probably under Government control.

Hemp.—Manila market remains as at last report; output for two weeks ended 19th instant, 58,000 bales. New Zealand hemp is in steady demand, and the market continues firm. June to August, high-point fair £84 10s., fair £83 10s.

Wheat.—Market fairly steady; a moderate business has been done in forward parcels. Canadian No. 2 hard winter, afloat, 79s.; No. 1 Manitoba Northern, 82s.

Oats.—Market quiet with a tendency in favour of buyers.

2nd June, 1917.

Meat.—Prices are lower for Home-killed mutton and beef, owing to large supplies of Argentine beef. New Zealand mutton 8¾d., ewes 8½d. Argentine mutton and lamb (small supplies) 10d. and 11d. New Zealand lamb, demand is very active notwithstanding double usual supply being available for the general public at 10d. per lb. New Zealand beef, no supplies available. Argentine chilled beef, hinds 11½d., fores 9½d.

Butter.—The market has a weaker tone since last report. Danish, salted 200s. to 204s.; New Zealand, salted 190s. to 194s., unsalted 190s. to 194s.; Australian, salted 186s. to 190s., unsalted 190s. to 192s.; Argentine, unsalted 186s. to 190s.; Irish, salted 188s. to 194s., unsalted 194s. to 198s.

Cheese.—Quotations are nominal owing to increasing supplies; no official quotations. Under new regulations the Food Controller will take over from importers all Canadian and States flats cheese; existing contracts to be cancelled; purchase prices to be settled later.

Hemp.—There is no material change in the market for Manila; the spot market bare. New Zealand hemp, market firm, but little doing owing to scarcity of offers; sales have been made at the following prices: high-point fair £87; fair £84, shipment by earliest opportunity. Fair, prompt shipment, £85.

Wheat.—A good business has been done. Canadian No. 2 hard winter, afloat, 79s.; No. 1 Manitoba Northern, 82s.; No. 2 Manitoba Northern, 80s. 6d.

Oats.—Market quiet, small business doing. Small sales of American have taken place at 67s. ex quay.

Beans and Peas.—All supplies afloat or for shipment are under Government control. No official quotations fixed.

9th June, 1917.

Meat.—Owing to small supplies of all descriptions of meat, record prices are being made for Home-killed mutton and beef. Home-killed mutton 17d.; Home-killed beef 16d. New Zealand mutton 8⅞d., ewes 8½d. Argentine mutton, no supplies available. New Zealand lamb 10d.; demand is in excess of supply. Argentine lamb 11d. Argentine beef is very scarce, hinds 13d., fores 10½d.

Butter.—The following maximum prices have been fixed for the next two weeks for salted and unsalted butter: New Zealand 200s., Australian 194s., Irish 196s., Argentine 190s., Danish 213s. The market continues dull, and prices are weaker. Danish, salted 200s. to 202s.; New Zealand, salted 186s. to 188s., unsalted 188s. to 190s.; Australian, salted 180s. to 186s, unsalted 182s. to 190s.; Argentine, salted 180s., unsalted 180s. to 182s.; Irish, 186s. to 190s.

Cheese.—No maximum prices have been fixed with the exception of English cheddar, 140s. Prices nominally 188s. to 192s.; no supplies available; no official quotations.

Hemp.—Manila market shows no change; output during the last two weeks, 30,000 bales. New Zealand quiet but firm; prices have slightly advanced for all grades; high-point fair £85 10s.; fair £84 10s.; common £82 10s.

Wheat.—Market steady and a fair business doing. Canadian No. 2 hard winter, afloat, 80s.; No. 2 Manitoba Northern, 81s.; Australian, 83s.

Oats.—Market quiet and prices slightly weaker. Canadian, 67s.; American, 66s.; Argentine, 64s., ex quay.

FORTHCOMING SHOWS.

Manawatu and West Coast A. and P. Association: Winter Show at Palmerston North, 19th to 22nd June.

Rangitikei A. and P. Association: Winter Show at Taihape, 27th and 28th June.

South Taranaki Winter Show Company (Limited): Dominion Dairy Show at Hawera, 2nd to 7th July.

***Student Assistants at Weraroa.*—On page 430 of this issue it is stated that of twenty-two students who have joined the Central Development Farm fourteen were accepted directly by the Department and eight are agricultural-bursary holders. The numbers should have been fifteen and seven respectively.**